AVIATION WEEK

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Each of these Honeywell men is a skilled teacher, capable of passing his knowledge on to Air Force technicians. And each has the special ability it takes to evaluate the composite effect on equipment of such local operating conditions as extreme heat, cold, humidity, dust, sand and moisture. Their observations are then passed on to Honeywell's engineering staff for use in improving the operation of Honeywell Controls.

This is just one phase of Honeywell's "follow-up" program which begins in Honeywell's research laboratories, continues into aircraft plants where controls are engineered individually to each airplane model, goes on through flight-testing, ends only when the equipment becomes obsolete.

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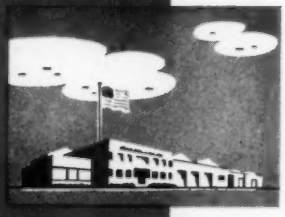

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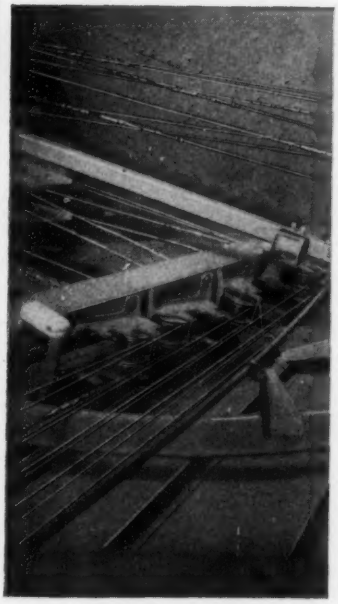

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ROEBLING

Aviation Week

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1 General Notepaper
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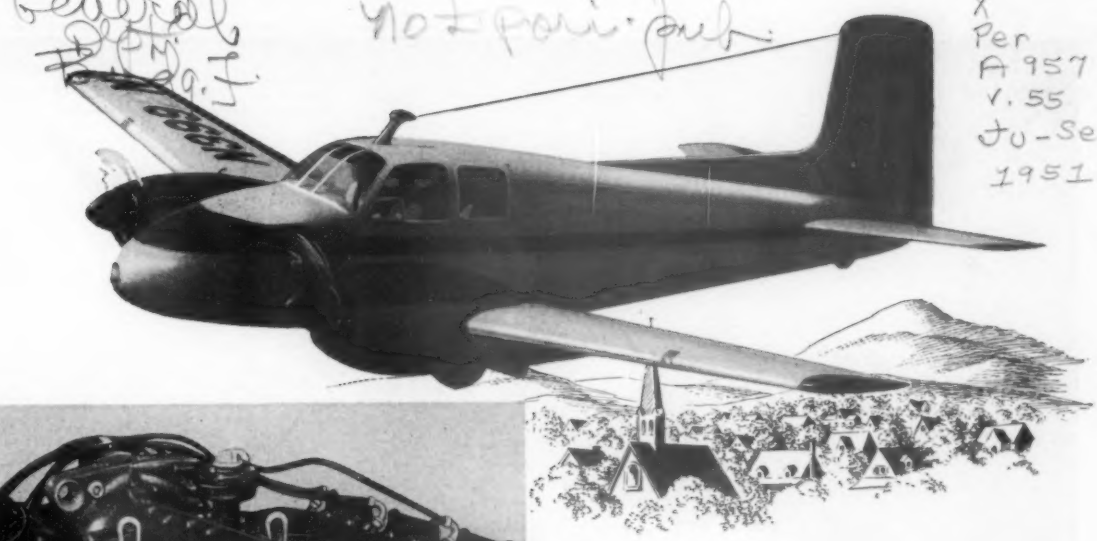

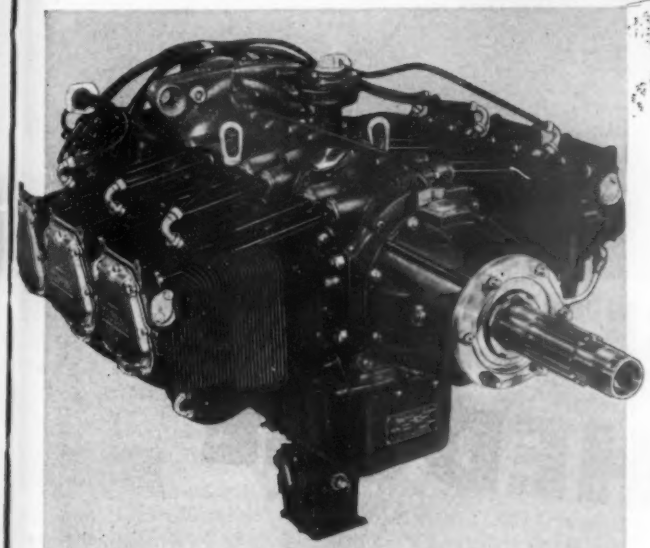

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FOR THE AVIATION INDUSTRY

NEWS DIGEST

DOMESTIC

Facilities contract for approximately $20 million is to be given Fairchild Engine & Airplane Corp. by Air Materiel Command covering the firm's newly acquired Air Force Plant 8 at Orchard Place, O'Hare International Airport, Chicago. Present tenants are scheduled to be moved out by July 15. They are: CAA, Army Ordnance, a government procurement office, Bureau of Public Debt, and the Smithsonian Institution, which has stored there a large number of aircraft slated for the pending Air Museum.

Pan American Airways Constellation crashed June 22 about 45 mi. north of Roberts Field, Liberia, killing all 31 passengers and crew of nine. The crash came after the carrier had flown more than four billion passenger miles without fatality since April, 1948. No severe weather or plane trouble was noted, but the pilot reportedly had mentioned some radio interference during the flight. This led to speculation that a new radio beacon at Dakar, French West Africa, might have interfered with the Roberts Field range. The plane's wreckage was found atop a 1,500 ft. hill.

Top prospective location for USAF Academy now is Randolph AFB, Tex. For the past two years, legislation authorizing a USAF Academy has been delayed by Congressional tugging over its location.

Personal and executive plane exports of 6,000 lb. and under (empty airframe weight) for May as reported to Aircraft Industries Assn. by nine companies totaled 41 valued at $257,984, compared with 40 worth $443,731 by the same firms the previous month.

Navy has awarded a production contract to North American Aviation for an undisclosed number of FJ-2 Fury sweptwing jet fighters (based on the USAF F-86 Sabre). The FJ-2 prototypes are to be built at NAA's Los Angeles plant. Production models will come out of the Naval Industrial Reserve plant at Columbus, Ohio, now being operated by the company.

Midcentral Air Procurement District was scheduled to occupy on July 2 the thirteenth and fourteenth floors, covering approximately 80,000 sq. ft., in the Butler Building, 165 North Canal St., Chicago. Previous offices were at 1660 E. Hyde Park Blvd. MAPD will maintain its own small business office at the new address. The District monitors AF contracts in a 12-state area.

Bell X-5, adjustable sweptwing research plane (AVIATION WEEK June 18), made its first flight at Edwards AFB June 20. The 30-min. hop was "smooth," according to Bell test pilot Jean (Skip) Zeigler.

First Cessna LC-126C, which carries two litters, pilot and medical attendant, has been delivered to the Army Field Forces. The LC-126C is basically a Cessna 195 and has a 300-hp. Jacobs engine.

Convair XC-99 was scheduled to fly again at Kelly AFB, Tex., following three months of extensive modification which included new landing gear to permit landings and takeoffs at gross weight of over 320,000 lb., improved square-tip props, sealed fuel tanks and a new electrical system. Prior to modification, the XC-99, while at Kelly AFB, transported 1,306,653 lb. of high priority cargo in six flights.

FINANCIAL

North American Aviation, Inc., Los Angeles, has declared a 50-percent dividend on outstanding capital stock payable July 25 to holders of record on July 3. This is the second dividend in NAA's current fiscal year, which began Oct. 1, 1950, making a total of $1.25 declared thus far.

Kaiser-Frazer Corp., Willow Run, Mich., has completed a $25-million credit under Regulation V loan from a group of banks, to be used for defense expansion.

National Airlines has declared its second cash dividend in history—25 cents a share. First dividend was this January and also was 25 cents.

INTERNATIONAL

Fairey Aviation Co., London, has named its new twin-engined carrier-based anti-submarine plane, hitherto called the Fairey 17 (page 9), the Fairey Gannet.

International Civil Aviation Organization Assembly, concluding at Montreal its fifth session, adopted a resolution whereby ICAO will cooperate with the UN General Assembly as well as Security Council in maintenance of peace.

An English Electric Canberra Mk. II bomber, one of first jet bombers designed and built in Britain, crashed on a railway siding during what was described as a routine flight, killing the test pilot.

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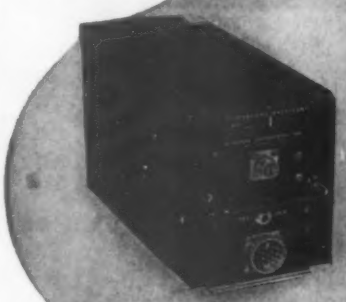

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A complete listing of Airborne's products for the aviation industry —ROTORette, Lineator, Rotorac and TrimTrol electro-mechanical actuators and ANGLgear right-angle bevel gear drive units—appears in the I.A.S. "1951 AERONAUTICAL ENGINEERING CATALOG." It will pay you to examine closely the curves, wiring diagrams and working drawings of these units which meet AN specifications and which are used on many modern planes.

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AVIATION CALENDAR

July 4-11—FAI annual conference, Brussels, Belgium.

July 4-12—National soaring contest, Elmira, N. Y.

July 9-13—Armed Forces Procurement Clinic, St. Louis, Mo.

July 17-18—European ignition conference, sponsored by Lodge Plugs, Ltd., Savoy Hotel, London, England.

July 23-24—Fifth annual meeting, University Aviation Assn., University of Florida, Gainesville, Fla.

July 24-28—Armed Forces Procurement Clinic, Cleveland.

July 28-29—Dedication of new Oneida County airport, Oneida, N. Y.

Aug. 6—International air race for the Daily Express Cup, England.

Aug. 11-19—Eighth annual Michigan aviation week, sponsored by the Aero Club of Michigan.

Aug. 15-19—Fifth annual all-woman transcontinental air race, sanctioned by the Ninety-Nines, Sana Ana, Calif., to Detroit, Mich.

Aug. 18-19—National Air Race, Detroit, Detroit-Wayne Major Airport.

Aug. 22-24—Western convention of Institute of Radio Engineers and Seventh Annual Pacific electronic exhibit.

Aug. 22-26—International convention of the Ninety-Nines, Mackinac Island, Michigan.

Aug. 24-26—Fifth annual convention of the Air Force Assn., Ambassador Hotel, Los Angeles, Calif.

Sept. 3-7—Royal Aeronautical Society-IAS third international aeronautical conference, Brighton, Sussex, England.

Sept. 10-14—Sixth national instrument conference and exhibit, sponsored by the Instrument Society of America, Sam Houston Coliseum, Houston, Tex.

Sept. 10-16—Seventh annual general meeting of the International Air Transport Assn., Westminster School, London, England. Program includes one-day visit to SBAC Farnborough show.

Sept. 11-16—Twelfth flying display and exhibition of the Society of British Aircraft Constructors, Farnborough, England.

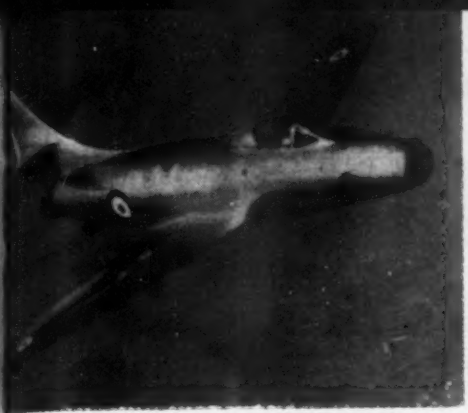
Oct. 2-4—Seventh annual aircraft spark plug and ignition conference sponsored by the Champion Spark Plug Co., at Toledo, Ohio.

Oct. 29-30—Air Industries & Transport Assn. of Canada annual general meeting, Seigniory Club, Montebello, Quebec.

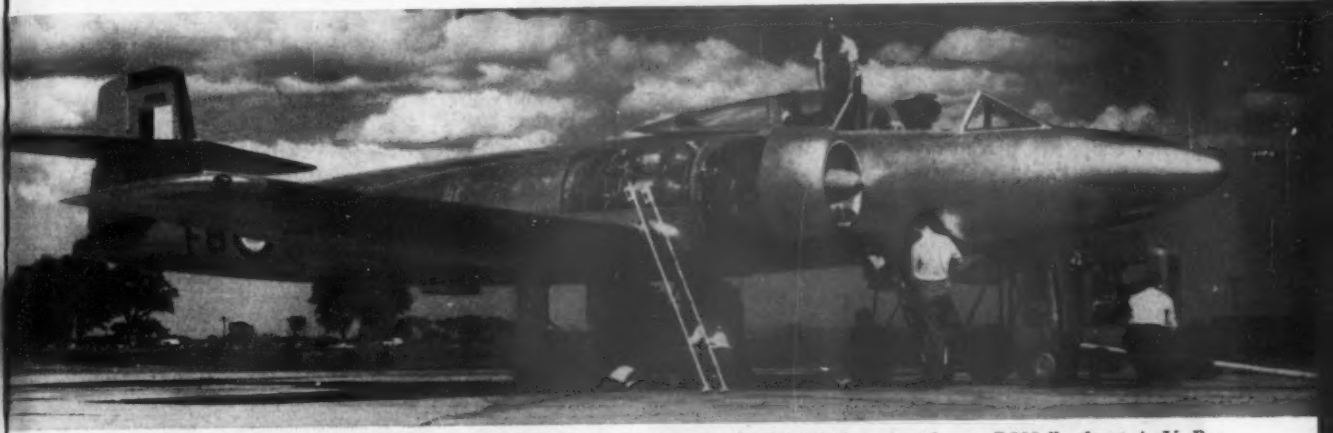
Oct. 31-Nov. 1—Society of Automotive Engineers, fuels and lubricants meeting, Drake Hotel, Chicago.

PICTURE CREDITS

9—(MD-450) Howard Levy; (CF-100) Keystone; 17—Howard Levy; 21—General Electric; 25—McGraw-Hill World News; 30—National Bureau of Standards; 39—Consolidated Vultee.



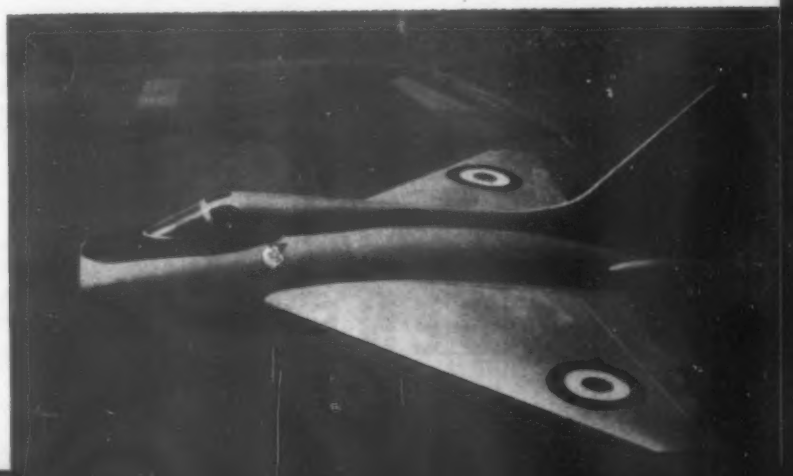
FIGHTING FAMILY—Straight-wing Dassault MD-450 Ouragan (Hurricane), above left, and its sweptwing development, the MD-452 Mystere, (right) figure importantly in French Air Force fighter build-up. Both use Rolls-Royce Nene. MD-452 has done over 625 mph.



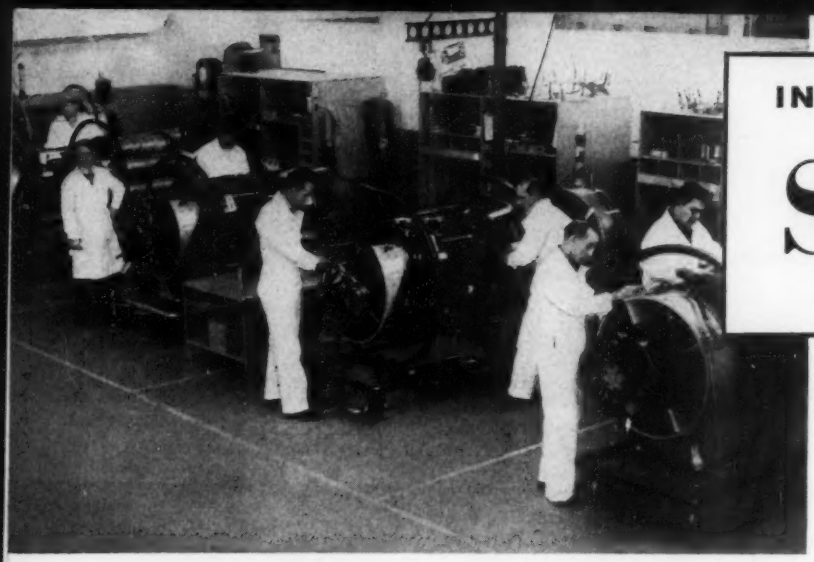
CANUCK GETS ORENDAS—First all-Canadian jet fighter, the A. V. Roe Canada CF-100 Canuck with new 7,000 lb. thrust A. V. Roe Canada Orenda turbojets gets last-minute check prior to first flight in mid-June. Previous CF-100s had British-built Rolls-Royce Avons.

BRITISH SUB-HUNTERS—Production-type Fairey 17 turboprop plane (above left) has front cockpits revised, a rear cockpit added (hidden by wing) and wing fences. Rolls-Royce Griffon powered Fairey Mk. 7 (right) carries two radar men in new rear cockpit.

New Foreign Military Planes



TRIANGLE TRIED—First flight view of Boulton Paul P.111 delta-wing research plane. It has a Rolls-Royce Derwent jet. Avro, Fairey have also built deltas.

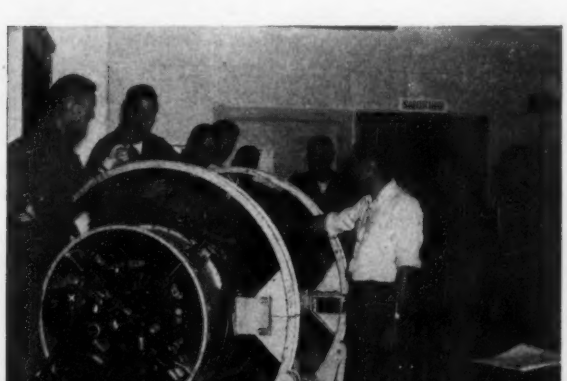


IN THE NEWS

SERVICE

Getting top utilization from jet engines requires many techniques. Here are a few of the means used by General Electric to help the Air Force get maximum use from its J47 engines.

To provide immediate service for General Electric apparatus, more than 30 G-E Service Shops are placed strategically around the country. Four of these shops are currently handling aircraft gas turbine work; more can be adapted as required. Skilled technicians provide rapid and complete repair and overhaul facilities.



At an Air Force base, a G-E representative shows Air Force personnel some fine points of jet engine servicing. To back up this field training, formal G-E jet engine schools have been functioning since 1942. Courses are now presented in familiarization, overhaul, flight test engineering, and line maintenance.

G-E service follows G-E equipment around the globe. Here, "tech reps" from General Electric and North American Aviation Inc. in Korea discuss combat performance of the G-E-powered, North American-built F-86 Sabre. G-E aviation field service representatives cover the vital spots in the world, are always available.

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AIRCRAFT GAS TURBINES

GENERAL ELECTRIC

210-23

WHO'S WHERE

RMI Reorganizes

Raymond W. Young has been appointed president and general manager of Reaction Motors, Inc., Rockaway, N. J., succeeding **Lovell Lawrence, Jr.**, head of the rocket motor firm since its inception, who becomes chairman of the board. Young previously was vice president-engineering for RMI, and held the same position with Wright Aeronautical Corp. prior to his move to Reaction Motors.

These changes highlighted several other organizational moves in RMI: **Harry B. Horne, Jr.**, former assistant to the executive vice president, stepped up to become manager of the engineering division, and **William P. Munger**, previously chief project engineer, became chief engineer.

The following continue as executives of the company: **Charles W. Newhall, Jr.**, executive vice president, also director; **John Shesta**, vice president-research, also director; **Henry H. Michaels, Jr.**, vice president-treasurer; and **Alexander L. Keyes**, secretary-general counsel.

Aeronca President **John A. Lawler** has become an RMI director, and **James H. Wyld**, of AEC was re-elected a director.

Changes

W. R. Burrows and **R. E. Coutant** have been promoted to assistants to the managers of engineering and sales, respectively, of General Electric Co.'s Aeronautic & Ordnance Systems divisions. . . . **Ben C. Hawk** has been designated chief industrial engineer at Convair's San Diego, Calif., plant and will have as his assistant **Paul Athans. Max G. Burland** has been made manager of industrial relations at the Ft. Worth division.

R. Elmer Minton has joined Republic Aviation Corp. as facilities coordinator to expedite the firm's expansion programs. . . . **Edwin D. Eaton** has been named chief of experimental operations for Hamilton Standard propeller division, United Aircraft Corp., and **Herbert N. Reitz** has been made assistant to the division's chief engineer. . . . **Dana W. Smith** has been named associate director of the division of metallurgical research for Kaiser Aluminum and Chemical Corp.

Ray R. Russell has joined service engineering department of Boeing-Wichita. . . . **W. R. Miller** has been designated manager of new Downey, Calif., plant of Rheem Manufacturing Corp.'s Aircraft division. . . . **John J. Hospers** has been promoted to assistant to the general manager of Chance Vought Aircraft division, Dallas, Tex. **Paul Thayer**, a former Vought test pilot, has been made sales manager. . . . **Robert W. Kellhofer** has been made Dayton representative for Fairchild Aircraft division.

Dr. Martin Mangels, Jr., has been named medical director of Pan American Airways' Latin American division, succeeding the late **Dr. John T. Macdonald.**

INDUSTRY OBSERVER

► Royal Canadian Air Force has ordered 22 Lockheed T-33 jet trainers for transitional training of pilots scheduled to fly Canadian-built F-86E and CF-100 jet fighters. Canadian government is in final stage of negotiations with Lockheed organization for licensing Canadair to build the two-place jet trainer in Canada. It is understood that the RCAF will place an initial order for 500 of the trainers which are expected to cost approximately $100 million. Deliveries are to start in the summer of 1952.

► **Northrop Aircraft's C-125 tri-motor Raider transports have been assigned by Air Force as practice test beds for mechanics training at USAF technical schools, replacing North American F-51 Mustang fighters. The C-125s are powered with three Wright R-1820 engines rated at 1,200 hp.**

► An in-flight refueling show with the Republic F-84G jet fighter and a Boeing KC-97 tanker with the Flying Boom system, didn't happen at the recent Aviation Writers Assn. convention demonstration on Long Island because: 1. The first F-84G wasn't quite ready for public flight; 2. Because the Republic prototype for refueling with the boom, a modified F-84E, had been torn down at Wright-Patterson AFB and couldn't be put in shape for the flight on short notice.

► **Air Force has wired all commands basing Boeing C-97 aircraft to make an inspection of wing-flap universal joints. Wire directs that older parts are to be removed and magna-fluxed and replaced if evidence of stress failure is found. Prior to the next major inspection of C-97 aircraft all old numbered parts are to be replaced, Air Force directed. An Air Force spokesman said the directive was based upon preliminary investigation into the cause of recent C-97 crash in Texas.**

► A team of personnel from USAF Air Materiel Command, Air Rescue Service, and Grumman have completed a two-month evaluation of the Grumman Albatross "triphibian" to determine the plane's suitability for operations under various snow conditions. During the tests the plane was operated from three separate bases at Bimidji, Minn., Kenora, Ont., and Anchorage, Alaska. The Grumman-developed triphibian can operate from land, water, ice or snow.

► **Next modification ordered on the North American F-86 line will be to equip the fighter with mid-air refueling equipment. Scheduled to be the next fighter so equipped, the plane will utilize the Boeing Flying Boom.**

► Consolidated Vultee is using a 91-ft. automobile truck to transport 75-ft. B-36 stabilizers from its subcontractor, Tex-Lite, Inc., Dallas, to the Convair plant at Ft. Worth. Convair reports a $600 savings over the previous method of shipping the stabilizers via three railway flat cars.

► **Wright Aeronautical has cut specific fuel consumption of its R-3350 Turbo-Compound to about that of the diesel. This should mean a figure of .35 to .40 lb./bhp./hr. Best diesel performance—for very large, slow speed engines—is about .33.**

► Douglas Aircraft Co. last week confirmed that it had received production orders for two types of guided missiles, one for Army Ordnance, the other for the Navy. Douglas is a subcontractor on both projects, and identified the prime contractor on the Ordnance missile as being Western Electric. The prime contractor on the Navy missile, not identified by Douglas, is Sperry Gyroscope Co. and the missile is the Sparrow (AVIATION WEEK June 11, p. 14).

► **Second Aerocar built by Molt Taylor, Longview, Wash., will have 11 sq. ft. more wing area than prototype full-span ailerons with greater differential deflection, a metal propeller, and a number of minor refinements and aerodynamic cleanup. It is due to make its first flight by the end of June. Changes follow tests of the Aerocar flying auto by Army's pilots at Fort Bragg, N. C. Wing changes were made mainly to satisfy Army requirements to clear a 50-ft. obstacle in a 600-ft. takeoff.**

Washington Roundup

Decline of Strategic Air

Diplomacy and domestic politics are heralding the demise of the intercontinental bombing concept of air-war.

State Department plans, still confidential, call for mutual defense agreements between the U. S. and virtually all nations of the non-Communist world. The North Atlantic Treaty Alliance, bringing ten European nations into a mutual defense agreement with the U. S. and Canada, is only the first step in State Department's diplomatic strategy for consolidating the free world against Russia.

Militarily, State's plans mean this:

• **A new era of U. S. diplomacy is beginning. Never before has this country relied on mutual defense pacts for protection. And this speaks the end of that military strategy that was founded on a mighty navy to keep the Atlantic and Pacific free of enemy forces and a long-range air arm to hit enemies at their home bases.**

• **In the era of mutual defense pacts** U. S. military strategy will be directed at "holding" approximately one-half of the world's land mass with land armies and tactical aviation support. There will be little need for intercontinental bombers from the land masses the U. S. plans to control; shorter range bombers will be able to perform a devastating air attack on any enemy aggressor.

Irony of the situation is that after years of aeronautical research have at last made intercontinental bombing technically feasible, the outlook is that the U. S. may have little military requirement for it.

State Department sources emphasize that for the indefinite future it's considered sufficient for the U. S. to maintain a potent "kernel" long-range strategic arm while military alliances with far-flung countries are being consolidated. But, they say, as these alliances are consolidated the requirement for an intercontinental strategic air force will decline.

There will be a last ditch, but futile, battle in the Senate to stem the present tide in our international dealings, and channel it back to isolationism with the intercontinental strategic airplane as the key to U. S. defense. The fight will be led by Nebraska's Sen. Kenneth Wherry and Ohio's Sen. Robert Taft.

But the oncoming Congressional battle over strategic air will have a basic difference from the battle waged by the prophetic leader in aviation, Billy Mitchell. Mitchell's battle was to prove the military merits of strategic aviation. The Taft-Wherry battle for greater emphasis on strategic air has a purely political, not military, base. Of late, the two powerful Republican leaders have grasped at strategic aviation as the military policy best tailored to their political aim: an isolated U. S.

They are opposed to State Department's plan for consolidating the U. S. world position through alliances.

Wherry, with Taft's backing, is now making a drive to have the Joint Senate Armed Services and Foreign Relations Committee, that has been taking down the far-embracing testimony on the dismissal of Gen. Douglas MacArthur, write into its report a recommendation that the U. S. adopt a policy of defending the non-Communist world by maintenance of an all-mighty U. S.-based strategic air arm.

But a solid bloc of Democrats, plus about 50 percent of the Republicans in the Senate aligned with internationalism, will kill off the Taft-Wherry program.

CAB Lawyers of Influence

Congress is lively with talk of the political weight of lawyers fighting out the Pan American-Panagra interchange case before the CAB.

This is a partial list:

• **Paul Porter,** former Price Control Administrator and director of the Administration's mission to Greece to work out a mutual defense plan. He appeared before CAB for his law firm, Arnold, Fortas, and Porter, on behalf of the four PAA directors of Panagra.

The firm's two other members are also former bright Administration political lights: Thurman Arnold once headed Justice Department's anti-trust division, later was appointed to the U. S. Circuit Court of Appeals by President Truman, a post from which he resigned for more lucrative law practice; Abe Fortas formerly served as President Truman's Undersecretary of Interior, spearheading his fight for public power. The Arnold, Fortas and Porter law firm also represents Air Cargo Transportation Assn.

• **Clark Clifford,** former Presidential counsel, and Joseph O'Connell, former chairman of the Civil Aeronautics Board, have been retained to assist Panagra's chief counsel, John J. Burns.

• **Smythe Gambrell,** influential Southern Democrat and one of the Democratic National Committee's heaviest and most consistent financial contributors. He represents Eastern Air Lines.

• **Cummings, Truitt.** Partner John Cross appeared for the firm of Cummings, Stanley, Truitt, and Cross, which includes former Attorney General Homer Cummings, and Max Truitt, son-in-law of Vice President Alben Barkley. Cummings, Stanley, Truitt, and Cross represented National Airlines. They also represent Mid-Continent Airlines.

• **Louis Johnson.** The former Secretary of Defense's law firm, Steptoe and Johnson, represents Pan American Airways. Steptoe and Johnson also represent Slick Airways before CAB.

Other lawyers of political influence practicing before CAB are:

• **James Landis,** former Chairman of CAB. He represents Colonial Airlines and Aerovias.

• **L. Welch Pogue,** former CAB Chairman. He represents Western Airlines, Resort Airlines, Metropolitan Air Commuting, Inc.

• **Joseph Davies,** the multi-millionaire Washington entertainer and former Ambassador to Russia. His law firm, Davies, Richberg, Beebe, Landa, and Richardson represents Colonial Airlines. Landa, recently named President of Colonial, gained political prestige as a Justice Department official during the Homer Cummings regime. Richardson served until recently as Chairman of the President's loyalty commission.

• **Northcutt Ely,** former Assistant Secretary of Interior. He represents Arizona Airlines.

• **Walter Gallagher.** He represents Fast, Inc., a freight forwarder. A former official of the Justice Department, he left the post to form a law partnership with Sen. Brien McMahon before the latter's election to the Senate.

• **Dennis Chavez,** son of Sen. Dennis Chavez of New Mexico, represents Trans-Caribbean Air Cargo Lines.

• **Burton K. Wheeler,** former Senator and close associate of President Truman, represents Coastal Cargo, Inc.

—**Katherine Johnsen**

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AF Reveals Plans for Engineering Center

Dedication of new facility at Tullahoma is first tangible step in seven-year-old plan.

By David A. Anderton

Tullahoma, Tenn.—The Air Force's Arnold Engineering Development Center, formally dedicated by President Truman here last week, started as a dream in the mind of the late Gen. H. H. Arnold. Today, that dream still has little substance.

And it will be, by the most liberal assumptions, at least three years more before the dream is all tangible.

This is not to underrate the effort going into the AEDC. Right now, the Army Corps of Engineers is constructing a dam to back up the waters of the Elk River for cooling and service water supply. One of the three proposed test facilities is about 30 percent complete. There is a finished warehouse and a network of access roads and an entrance highway.

And the Air Force (perhaps optimistically) expects to make the first shakedown run in the spring of 1952.

At first glance, the accomplishments at AEDC appear prodigious, and their plans ambitious.

But a second look at the whole program—including its seven-year history and its German foundations—is more revealing than surface accomplishments.

▶**Plans**—Three major test installations are contemplated for the Arnold center:

- **Engine test facility,** which is the top priority unit. This installation, when complete, will be able to test full-scale turbojet and ramjet powerplants up to simulated altitudes of 80,000 ft.
- **Gas dynamics facility,** the second priority item. This setup is intended for developmental testing of aircraft models up to hypersonic speeds at very high Reynolds numbers.
- **Propulsion windtunnel,** last on the priority list. This is slated for development testing of full-scale, operating ramjet and turbojet powerplants as installed in aircraft, plus full-scale components of aircraft. Test-speed range proposed for this tunnel extends up to Mach 3.5.

Two of these facilities—the engine test and gas dynamics—are the result of far-seeing planning on the part of the German Air Ministry during World War II.

▶**How It Began**—Toward the end of World War II the USAAF, probably after comparing its own meager facilities with the prodigal installations of the defeated Germans, began studies aimed at increasing its own test capacity. In November, 1944, Gen. Arnold assigned Dr. Theodore Von Karman the job of investigating "all the possibilities and desirabilities for postwar and future war's development as respects the Army Air Force."

The recommendations of Dr. Von Karman's group included one that an air engineering development center be built to cope with the new problems of flight.

The St. Louis firm of Sverdrup and Parcel, Inc. began a survey of possible sites for the AEDC in June of 1946. The strategic location of the facility, the tremendous amounts of power and cooling water required, land area available and proximity to other projects had to be considered in any site selection.

▶**NACA Too**—Concurrently with the Air Force's studies, the Raymond Panel of the National Advisory Committee for Aeronautics was mulling over the ideas that crystallized in the unitary windtunnel program.

Somewhere along the line, the AEDC program and the unitary plan were coordinated. In 1949, presentations were made to the President's Air Policy Commission and the Congressional Aviation Committee. Both of these groups passed their approval of the program along to the office of the Secretary of National Defense.

Shortly after, the Research and Development Board approved an interim program and passed it along to the Secretary of National Defense.

Proposed legislation was submitted to the 81st Congress on Mar. 9, 1949. Congress passed the legislation; it was approved by the President on Oct. 27, 1949. As Public Law 415 of the 81st Congress, it authorizes $100 million for the establishment and initial construction of AEDC.

Late in 1949, the Secretary of the Air Force formally announced the selection of a 34,000-acre site within the military reservation at Camp Forrest, near the little town of Tullahoma, Tenn.

▶**Chain of Command**—AEDC was an operational unit of the Air Engineering Development Division of the Air Research and Development Command. Within the next month, AEDD will be redesignated as the Arnold Air Development Center.

Currently, AEDD has technical and administrative control over Aro, Inc., a civilian corporation set up under contract to the Air Force to manage and operate the Tullahoma facility. AEDD further has the same measure of control over Sverdrup and Parcel, Inc.

As an interesting sidelight, Aro, Inc. was formed by Sverdrup and Parcel, Inc.; right now, Aro is performing an additional duty of reviewing Sverdrup and Parcel's design of the technical facilities.

Aro's organization and relationship to the Air Force is similar to those of private contractors to the Atomic Energy Commission.

▶**Installations**—The engine-test facility at the Tullahoma center is to be built and expanded around the core of what was the Munich plant of the Bayerischen Motoren Werke, Germany. This Munich facility was approved by the German Air Ministry in May, 1940, and construction began in August, 1941. Three stages of plant capacity were planned, but only the first stage was completed for test work before the war ended. The facility began operating in October, 1944, and continued testing until the surrender.

After V-E day, both the British and Americans ran engine tests in the facility at Munich. In 1946, the plant was dismantled and shipped to the United States, where it has been stored at Alameda, Calif.

The German design called for test capacity at airflows as high as 97 lb. sec. at sea level and altitudes as high as 54,000 ft. The redesign of this facility will raise the test altitude to 80,000 ft., and the test air flow to higher values.

The gas-dynamics facility is to be based on the design and initial construction of a similar German unit which was begun just prior to the end of the war. These drawings—and presumably such parts as were fabricated—were made available to the USAF.

▶**Engine Test**—Three test chambers will be the heart of the engine test installation. These sections will be about 12 ft. in diameter and may be extended to various lengths, a typical dimension

being about 40 ft. Four motor-driven air-supply compressors will feed air to these test chambers; six exhausters will evacuate the downstream side for altitude test.

Auxiliary equipment will include refrigeration and drying components and exhaust gas coolers.

Power demand of the facility, fully operating, is estimated between 75,000 and 90,000 hp. The building occupies a space about 450 ft. by 600 ft.

For testing, an engine will be brought to its particular test chamber by a railroad feeding the three chambers. Quick-disconnect doors will provide access to the chambers. Each test section will have a connecting room complete with all controls and instrumentation.

▶ **Gas Dynamics**—Here it is planned to have two test sections each 40 in. by 40 in. The Mach number range covered begins at 1.2 and goes to above 5. Major advantage of the facility is that this Mach number range is combined with a Reynolds number range which is considerably greater than currently available.

The air supply is to consist of 12 centrifugal compressors driven by synchronous motors totalling 90,000 hp. Each test section will be equipped with adjustable nozzles, optical instrumentation, force and pressure measuring equipment, heat exchangers and driers.

Building area is about 400 ft. by 500 ft.

▶ **Propulsion Windtunnel**—This installation is planned to be a continuous flow, closed-circuit tunnel with two test sections. One will cover the transonic range from a Mach number of 0.8 to about 1.4. Its shape will be octagonal, with a dimension about 18 ft. across the flats.

The second test section will cover the speed range from Mach 1.4 to more than 2.5 (upper limit was once stated at Mach 3.5) and will be 16 ft. square.

About 200,000 hp. will be required to drive the tunnel, and about 100,000 gpm. of cooling water will be used for controlling temperature within the tunnel.

Systems for scavenging combustion products from operating powerplants and for supplying make-up air will be incorporated in the tunnel.

▶ **Progress Report**—Last week the President's party and the press were whisked past crated German equipment standing in the open at William Northern Field, Tullahoma's airport. The motor cavalcade sped through a single shop building, packed with German equipment being rehabilitated. Few workmen and fewer machines were in evidence.

From Northern Field, the party went directly to the AEDC and toured the area. First pass was through a warehouse, which was completely empty except for luncheon tables.

Then the group rode past the engine test facility, which, an Air Force guide said, was about one-third completed. The guide also made the statement that the AF expected to make its first run next spring. Judging by the state of construction of the facility, and after checking opinions with some engineers in a position to make an estimate, AVIATION WEEK concludes that the date is quite optimistic.

Such German equipment as could be inspected at close hand was found to be deteriorating rapidly. At Northern Field, for example, exhauster parts, tremendous pipe fittings, pressure vessels and small water turbines are standing out on the concrete apron, completely exposed to the weather. All visible bolts and flanged connections were completely rusted over. There had been no attempt to cover the parts with any coatings of protective material; and there was no indication that the few parts in closed crates had been properly sealed and protected against moisture.

▶ **Completion Dates**—Considering the visible evidence of the state of the German equipment, and the progress of construction, original AF estimates of 1955 as the completion date for the facility seem out of line by about two years.

In addition to the test facilities, there must be a complete central facility for electrical power distribution, steam plants, water systems and fuel systems. Offices, shops, cafeterias, fencing will be needed. An air strip is included in the planning, as well as a new local road net.

Final personnel requirements are estimated at 2,000. Total cost of operating the facility is currently placed at $10 million annually. Estimated initial cost of the total installation has been placed at $157 million.

Research Command Starts to Function

A brand new Air Research and Development Command just handed over to Maj. Gen. Earle E. Partridge is rapidly taking shape and will soon be open for business in Baltimore, Md. Guiding hand in the reorganization, however, is still Maj. Gen. David M. Schlatter, who temporarily remains with ARDC as deputy commanding general until the new command is on its feet.

Air Research and Development agencies lifted bodily out of Air Materiel Command jurisdiction as a result of USAF Ridenour Committee recommendations to eliminate scattered authority and confusion are now in the midst of their own game of musical chairs.

▶ **Redesignation**—Redesignated thus far is the former Air Development Force at Wright-Patterson AFB. It becomes the Wright Air Development Center. Similarly, electronic research formerly handled by Watson Laboratories at Red Bank, N. J., and moved to Griffis AFB, Rome, N. Y., becomes Rome Air Development Center.

Next month, the Guided Missile Long-Range Proving Ground at Cocoa Beach, Fla., becomes the Air Force Missile Test Center; and the Air Engineering Development Division at Tullahoma, Tenn., becomes the Arnold Air Development Center.

Also to be reestablished under the Air Research and Development Command is the Cambridge Research Laboratory, Cambridge, Mass. This is to be redesignated Air Force Cambridge Research Center. In still another renaming operation, Edwards AFB, at Muroc, Calif., becomes the Air Force Flight Test Center.

Holloman AFB, N. M., adjacent to Army's White Sands Test Center, used to test USAF's short-range guided missiles will retain its present designation.

▶ **Battle Result**—Establishment of the new command followed a bitter yearlong battle by Air Materiel Command and specifically Lt. Gen. K. B. Wolfe to hold research and development as a part of the Air Materiel Command.

Actual decision to separate procurement responsibilities from those of research and development was made while the late Gen. Muir S. Fairchild was still USAF vice-chief of staff. The general proposed establishment of a committee to study the top-heavy organization of Air Materiel Command and to make recommendations for its streamlining.

As a result, about a years ago, the Air Force established the Ridenour Committee to examine research and development in the Air Force. Headed by Louis N. Ridenour, president of University of Illinois, the committee included: retired Gen. James H. Doolittle, Geo. P. Baker, James D. Fiske, Carl S. J. Overhage, Ralph Sawyer, Frank Wittendorf, James D. Wild, Raymond Woodrow and Dr. Theodore von Karman, chairman of the Scientific Advisory Committee who transmitted the report of Gen. Fairchild and ultimately to Gen. Hoyt Vandenberg, USAF chief, for decision.

▶ **Lines Of Authority**—First indications of the pending reorganization of research and development functions came last year when Department of Defense issued a directive June 13 redesignating lines of authority of the various research field bases.

In this command switch, the Joint Long-Range Proving Ground which is located at Cocoa Beach Fla., was removed from Joint Chiefs of Staff control and returned to Air Force. Army was given complete control of its White Sands, N. M. Proving Ground and Navy retained full control of its Point Mugu, Calif., facility.

UAL PILOTS at carrier's Chicago offices took to picket line instead of flight line.

Strike Issue: Less Time in the Air

Faster planes mean more distance covered for same pay; so pilots wary of settlement tied to DC-6B use.

The airline industry still had a major strike on its hands last week as the walkout of 900 United Air Lines pilots wore on into its second week with no outlook for imminent settlement.

United, its planes grounded in the 22 states and to Hawaii, estimated it was losing $100,000 a day net income—$400,000 daily gross revenues. The strike started June 19.

The pilots, members of the AFL Air Line Pilots Assn., continued to picket and await developments. These were slow.

▶**Truce Bid**—A week ago, Presidential pressure—main government resort in such cases—got the pilots to agree to go back to work on a "truce" basis. President Truman based his appeal on the national welfare.

At mid-week, after some reports of possible government seizure of UAL, W. A. Patterson, United president, told the White House the company favored an immediate end of the strike on the basis of service as it was when the pilots went off the job June 19.

But he gave priority to settlement of differences involving UAL's new Douglas DC-6Bs, nub of the dispute over hours that was at the roots of the trouble, before other items could be discussed in negotiations following a pilots' return to work.

▶**Truce Off**—This the pilots did not accept. Patterson's wire to Truman had stated that United would be willing to restore service at midnight June 26 as it had been a week earlier (when the pilots went off the job), "provided that thereafter there is no negotiation or mediation on any issue in dispute until the strike on the DC-6B, which started Apr. 29, 1951, is settled and the pilots are flying those planes in scheduled service."

Wednesday morning, the strike was still on. There was only conjecture as to what the next move might be.

▶**The Real Issue**—The question involving the DC-6Bs (AVIATION WEEK June 25, p. 13) appeared to many as a harbinger of problems of the future, when even faster planes may be common.

Faster planes mean less time between points, more takeoffs and landings, more miles covered in the same flying time. Flying time for a pilot now is limited to 85 hours a month. UAL wants to keep it at that, but the pilots want it cut to 70, and ask a new salary basis in connection with the DC-6Bs.

They have asked United to set at 17,500 miles the monthly maximum of pilot flying, and that would cut flying time. The same request has been made of American Airlines, which is flying its DC-6Bs while United's have not been put into service because of the pilot's refusal to fly the planes without a new salary arrangement.

▶**AA Counter-Move**—American's pilots had talked of refusing to fly AA's new faster planes. Vice President Lawrence Fritz told all AA bases to post a notice guaranteeing suspension of every pilot refusing to fly the DC-6B. The pilots did not strike the DC-6B on the date set for it—June 25—first day after the 30-day cooling-off period required after release of the Presidential Emergency Board recommendation.

Some observers considered the notice unnecessary, reasoning that the pilots were making their point with United and similar action against AA was unlikely. AA pilots reportedly apprised the National Mediation Board of the incident and subsequently AVIATION WEEK was informed, all station managers were ordered by AA to tear down the notices.

▶**Background**—The dispute between the pilots and UAL—which in addition to reduction of maximum hours and more pay for the DC-6B than the standard DC-6 covers such points as deadheading and limitation on hours of standby—has been going on over a year before the NMB. The Railway Labor Act requires that workers stay on the job after they have accepted mediation until the mediator declares he can not make progress.

But there usually is no enforcement on this, and an appeal to the White House, the action taken by NMB in the current issue, can follow.

One of the many background factors in the situation that is causing some behind-the-scenes anxiety in airline management circles is this:

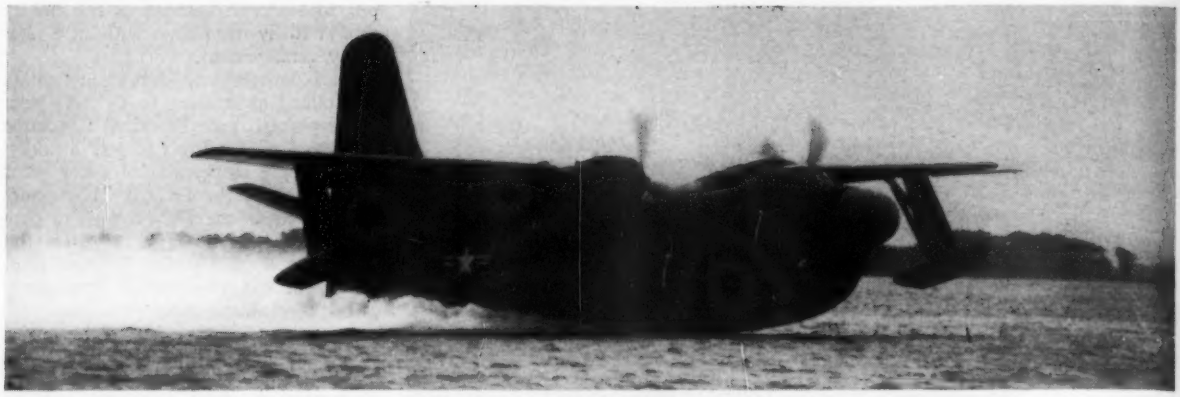
There is already an acute shortage of airline pilots. Some who have had other jobs for a long time are back full or part time as copilots. Shorter monthly flying maximums or a mileage limitation could mean a tight situation on pilot availability if it were coupled with increasing frequencies and growing air traffic.

Tht is one horn of airline management's dilemma—shorter hours mean more pilots, who are unavailable. The other horn is simply that a shortage of anything puts the one holding the supply in the driver's seat. And ALPA controls the pilots.

Turboprop Testing

In his supplemental appropriation request for fiscal year 1952, President Truman has asked Congress for $600,000 for turboprop and turbojet transport testing under sponsorship of the CAA Prototype Aircraft Testing Committee, headed by Harold D. Hoekstra.

Part of the money is to go for testing B-45 jet bombers on simulated commercial transport operations.



Martin's First Production P5M Marlin Flies

First production Martin P5M-1 flying boat made its initial test flight near Baltimore last week and remained airborne for about 20 minutes. After a series of tests by the Glenn L. Martin Co., the twin-engined plane will be delivered to the Navy Air Test Center at Patuxent, Md., for further tests before delivery to an operational Navy unit.

The big, gull-winged seaplane is powered by two Wright Turbo-Compound engines each developing 3,250 hp. Wing span of the P5M-1 is 118 ft., length 90 ft. 3 in., and height of the plane from keel to top of stabilizer is 35 ft. 2 in. Designated the Marlin, the P5M-1 is comparable in size with its forerunner, the PBM Mariner, but is considerably heavier.

The Marlin is scheduled to replace the World War II Mariner as soon as production is stepped up. Designed for a primary mission of detection and destruction of enemy submarines, the plane is said to be one of the most completely electronically equipped planes ever to be put into operation by the Navy.

In appearance, the main difference between the Marlin and its older counterpart, the Mariner, is that the Marlin features a single-tail vertical stabilizer in place of the twin-tailed configuration of the earlier PBM. Additionally, the Marlin has a more streamlined afterbody.

Little data of the plane has been disclosed by the Navy, although it has been said that the plane includes a radar-bow scanner and both external and internal armament. The plane carries a crew of seven.

TWA Studies Major Plane Deals

Carrier would order six more L-749A Constellations and swap older Connies to NWA for Stratocruisers.

Trans World Airlines is wing-deep in new equipment plans and negotiations revolving around three outstanding—though still tentative—developments:

- **A Constellation for Stratocruiser** swap with Northwest Airlines.
- **Higher power** from the Pratt & Whitney Aircraft R-4360 engines powering the Stratocruiser.
- **A new order** for six Lockheed L-749A Constellations, and conversion of five more Constellations to 81-passenger air coaches.

But Lockheed is not sure it can accommodate the late TWA order for the L-749s and still switch its assembly line over to the big L-1049s in time to make good on the delivery schedules promised for the latter plane.

With delivery of the six new L-749As uncertain, TWA may hesitate to enter into the Northwest deal even if it could be arranged. As presently being discussed, TWA would turn over to NWA 12 older L-749s, plus cash, for Northwest's 10 Stratocruisers. The two carriers last year failed to clinch a similar deal because they could not agree on the amount of the cash payment.

What gives TWA renewed interest in buying Stratocruisers this year is Pratt & Whitney's recent improvements on the R-4360 engine—the engine used in all Boeing 377s.

The most recent R-4360 engine modifications for new Air Force Stratofreighters and tankers promises to deliver 3,800 wet-takeoff horsepower, plus much improved reliability and higher cruise power.

▶ **Improvements**—Airlines owning Stratocruisers are winding up negotiations with Pratt & Whitney to make major modifications of their engines. They will first operate the modified engines at the present conservative power settings. But they hope to jump the cruise power when they prove out the improved reliability of the modified engine. Pratt & Whitney is not going to promise the airlines any increases in allowable power settings on the modified R-4360 engine—cruise or takeoff.

Some of the improvements in the Air Force R-4360s going in the Boeings are heavier rear case, bearing change throughout, improved nose-prop gearing, and different cylinder-head finning. The engine is generally beefed up, making it somewhat heavier but much more reliable. Boeing is going to flight test the military installation of the modified R-4360 and Pan American is testing a commercial installation.

Trans World reportedly would like to make the ten Northwest Airlines Stratocruisers into 56-passenger luxury liners somewhat like those of American Overseas Airlines before Pan American took them over.

▶ **More Changes Coming**—Then, in four years or less, the modified R-4360 engine may be converted to or replaced by Pratt & Whitney's ultimate R-4360 development now reaching final stage—the completely turbo-supercharged engine. This is planned first for military use. But its much improved fuel economy and power may mark it as the ultimate reciprocating engine development to move the commercial Stratocruiser at high cruise speed and low cost.

Reports are that this future turbo model of the Pratt & Whitney engine would enable the Stratocruiser to cruise at 29,000 ft. with 8,000-ft. cabin pressure altitude. Claims for improved fuel economy over the present R-4360 model run as high as a 20 percent saving, with over 4,000-hp. for takeoff.

Air Force has been flying the pusher

version of the R-4360-53 engine on the B-36F since early this year. The R-4360-53 is rated at 3,800 horsepower. A tractor version of the same engine is going into some new C-97s.

One big worry of commercial airlines planning to modify their R-4360 engines is priorities on delivery. Air Force orders are slated to take precedence over commercial at Pratt & Whitney. And Air Force orders for the modified engine are heavy.

Hughes Boat to Fly Late This Month

New lease agreements worked out between Howard Hughes and Reconstruction Finance Corp., disclosed last week, require that the huge eight-engined plane must be flown by Sept. 1.

The decision is an outgrowth of a suit entered in March by Hughes Aircraft to recover approximately $2.5 million spent in connection with the flying boat development at Culver City, Calif. RFC allowed the suit to be entered because both the company and RFC sought clarification of early negotiations conducted in 1944.

Under previous terms of the lease, the 300,000-lb. plane was to have been flown by June 1, (AVIATION WEEK Apr. 2) but the company sought a 90-day extension so that Pratt & Whitney engine installation changes and other modifications could be thoroughly tested before new trials of the plane began. RFC agreed and the new contract was formalized Apr. 19.

▶**Coming Out**—West Coast sources predict that Hughes will probably get the plane out of its hangar and into the air over Terminal Island in Long Beach Harbor during the last week in July. Company spokesmen say that Hughes will then personally take over a long programmed series of flight tests.

Speculation that the flying boat is to be a forerunner of the world's first atomic-powered aircraft continue to carry considerable weight in some quarters of official military aviation circles in Washington. Top civilian and military authorities have predicted that the first atom-powered aircraft would be about the size of the Hughes plane, and further, that the flying boat would make a convenient vehicle to carry the first atomic engine. These authorities have pointed out that a flying boat could land and take off in areas where large population groups would not be endangered.

Under terms of the new RFC-Hughes contract, (and adding spice to the speculation that the Hughes plane might be used for the atomic engine tests) is the clause that RFC not only will continue to be owner of the plane in its entirety, but that it retains the right to use the plane "for government benefit." The clause further specifies that government benefit does not imply use for private or commercial purposes or acquisition of any equipment or technical knowledge developed in past experiments by Hughes.

▶**Many Millions**—The big seaplane, designated HK-1 and unofficially nicknamed "The Hercules" has cost the government approximately $18 million and RFC owns all rights to the plane. In addition, Howard Hughes has spent another $17 million of his own money in developing the plane. This has been spent, a company spokesman told AVIATION WEEK, at a rate of about $300,000 per month.

The HK-1 is powered by eight Pratt & Whitney Wasp Major R-4360 engines developing 3,000 hp. The plane has a wing span of 320 ft. 6 in.; a hull length of 218 ft. 6¼ in. Height from hull bottom to top of vertical fin is 79 ft. 3⅜ in. Performance specifications call for a cruising speed of 175 mph. and a top speed of 218 mph. and a cruising range of 3,500 mi.

WSB Airframe Unit Planning Hearings

The six-man Airframe Committee set up by the Wage Stabilization Board to study the need for special procedures for handling wage controls in aircraft met with members of the board last week to plan its work and schedule hearings.

The committee, headed by Howard S. Kaltenborn of the University of California Industrial Relations Institute, reviewed the industry's wage problem—chiefly one of attracting needed manpower and skills—with WSB Chairman George W. Taylor and Hiram S. Hall and John W. Livingston, industry and labor members, respectively, of WSB.

▶**The Committee**—Among those serving with Kaltenborn, formerly director of industrial relations for Curtiss-Wright Corp., are Sheldon Elliot, dean of the Law School at the University of California at Los Angeles, public member; Robert H. Biron, Jr., vice president of industrial relations of Consolidated Vultee, and Daniel W. Siemon, industrial relations manager for Glenn L. Martin, industry members, and William Kircher of the CIO United Automobile Workers and Dale Reed of the International Assn. of Machinists, labor.

Ben Aaron, who headed the War Labor Board's Airframe Panel, was unable to serve on the committee. Livingston, head of the UAW-CIO Aircraft Department, was expected to be on the committee, but his assistant, Kircher, will serve instead.

AVIATION WEEK last week reported on the new Airframe Committee and a 15-cent hourly wage increase approved for Republic Aviation Corp. but inadvertently referred to Fairchild instead of Republic in the latter part of the story. The story should have referred only to Republic.

▶**Fairchild Increases**—A few weeks ago WSB approved 14 cents of a 15-cent increase negotiated between the Fairchild Aircraft division, Hagerstown, Md., and the CIO Auto Workers. One cent was not approvable "at this time" because of the 10-percent formula. Six other concessions in the Fairchild-CIO agreement were: (1) An extra five cents an hour for "lead men"; (2) Vacations on a prorated basis for employes being laid off; (3) Extension of hospitalization coverage to employes on leave of absence; (4) Changes in wage rules concerning downgrading, applicable to transfers; (5) Change in administration of in-grade adjustments, and (6) Automatic monthly increases of five cents an hour during the first three months of employment.

NIGHT BIRD

First photo of the rarely seen all-weather McDonnell F2H-2N Banshee night fighter, which differs from other Banshees in that it carries extensive radar gear for picking up and tracking hostile aircraft. It is easily spotted by the large white radome in the extended nose. Standard armament of four 20-mm. cannon is retained. The large capacity wingtip tanks extend the F2H-2N's duration considerably. Fitted with two Westinghouse J-34 axial-flow turbojets, the plane's top speed is well over 600 mph.

FINANCIAL

Avco Drops Aviation Investments

With sale of American Airlines shares, group moves another step from holding to operating company.

Avco Manufacturing Corp. has completely liquidated its most profitable aviation investment. In selling its remaining block of 257,690 shares of American Airlines, Inc., Avco realized a capital gain of more than $3.5 million on an investment last carried on its books at $322,122.

At one time, Avco (through its predecessor Aviation Corp.) owned about 22 percent of American Airlines common stock. This was represented by 287,538 shares of the old stock (prior to the five-for-one split). The Civil Aeronautics Board, in October, 1945, ordered the holding company to divest itself of the bulk of its American Airlines stock.

The divestment order could not have come at a more opportune time to benefit Aviation Corp. During 1946, 211,000 shares of the old stock were sold, at what now appears to have been near peak prices, for a profit of almost $17 million, before taxes. This left Avco with the 257,690 shares, or 3.99 percent of the American Airlines common, recently sold.

▶**Out of Aviation Investment**—This final liquidation of the American shares also represented the disposition of Avco's last aviation investment. Earlier this year, Avco sold its 60,000 shares of Roosevelt Field, Inc., representing some 20 percent of the outstanding stock at a capital gain in excess of $500,000 on an investment last carried on the books at $30,000.

In May, 1950, Avco disposed of its entire block of Pan American World Airways. The 366,954 shares involved realized a gross of about $3.4 million with an indicated book profit of around $1.1 million.

When the Pan American shares were sold, the Avco management indicated that this was just another major phase in its long-range program of removing itself from aviation and concentrating in those fields in which its main activity centered. It is significant that the recent sale of the American stock was considered by Avco as another step in its transition from a holding to an operating company.

▶**Into Aviation Manufacturing**—The fact remains that Avco is increasing its relative position in aviation through aircraft manufacturing. The company has retained its Lycoming-Spencer division, which has military contracts for the manufacture of light aircraft engines and auxiliary power units for starting jet and heavier reciprocating aircraft engines.

Avco has indicated that during 1951, Lycoming-Spencer expects to devote virtually all of its capacity to defense production. Under contracts with the Army, the division will also manufacture air-cooled engines for use in light and medium tanks and other ordnance equipment.

Further, and of greater importance, early this year Avco was awarded an Air Force contract for the production of aircraft engines. This operation will be conducted in the old Chance Vought plant at Stratford, Conn., which is being leased from the government.

Nevertheless the fact remains that Avco's present activities devoted to aircraft manufacturing are of small proportion and are completely overshadowed by its interest in consumer-type goods, covering home appliances, farm equipment and broadcasting facilities.

It is significant that it was the profits from aviation enterprises which permitted the Avco management to attain its present stature and become a major factor in such fields as television and farm equipment.

Avco started life as the Aviation Corp. in 1929 as a holding company for aviation securities. It owned such old-time aviation properties as Colonial Airways, 99 percent; Universal Aviation, 91.2 percent; Embry-Riddle Aviation Corp., 67 percent; Interstate Airlines, Inc., 100 percent; and Southern Air Transport, 99 percent.

This was not all. It held 53.3 percent of the old Fairchild Aviation Corp.; major participations in Roosevelt Field, Inc., Bendix Aviation, Fokker Aircraft, Pittsburgh Metal Aircraft, Western Air Express, Waco Aircraft, The B. G. Corp., and others.

▶**Line Builder**—In 1930 the parent holding company concentrated its airline efforts by combining the system that ultimately developed as American Airlines. It also was a major factor in launching PAA. The management of Aviation Corp. shifted to new interests in 1937. At that time, in addition to the holdings in American Airlines and Pan American Airways, investments extended to the old Vultee Aircraft Company, Lycoming and Stinson in the aircraft field.

As aircraft procurement accelerated during the early phases of war preparedness, Vultee, after first acquiring a controlling stock interest in Consolidated Aircraft Co., was merged with that property. The new group was known as the Consolidated Vultee Aircraft Corp. and contributed substantially to Aviation Corp.'s earnings in this period.

In 1947 Aviation Corp. removed itself from the airframe manufacturing industry in a corporate twist which segregated Convair's holdings. In one of the most intricate deals in aviation finance, the non-aviation properties of Convair were centered in the newly created Nashville Corp. The latter became the repository of the consumer goods manufacturing activities previously conducted by Consolidated Vultee Aircraft Corp.

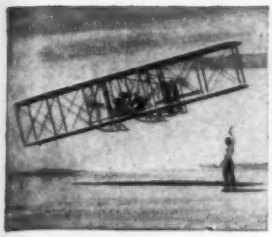
At the time of this segregation, the Aviation Corp., which had now become Avco Manufacturing Corp., owned 410,417 shares of Convair, carried on its books at $5,299,013. At the then prevailing market prices, it would appear that Avco suffered an apparent loss of about $1 million in the disposition of the aircraft property. This is misleading, however, as substantial income in the form of dividends were received during the war years and it is not known what ultimate realization may be had from the facilities which went into the Nashville Corp.

Interestingly enough, a number of Avco's non-aviation investments have not done well at all. For example, prior to the recent sale of the American Airlines stock, the company sold its interest in ACF-Brill Motors Co., a bus manufacturer, realizing a capital loss estimated at around $2 million. This will, in part, offset the capital gain realized on the American sale, thus minimizing the tax liability.

Avco continues to hold about 25 percent of the total equity stock of the New York Shipbuilding Corp. This entire investment was last carried on its books at $2,827,159. At current market quotations Avco has an unrealized capital loss of around $900,000 on this investment. This excludes any consideration of dividends received from this holding in past years. But the New York Shipbuilding investment was nowhere as profitable as Avco's past commitments in American Airlines, Pan American, Convair or Roosevelt Field.

Avco's aviation commitments have served it well, but the company is no longer the major factor it once was in this field.

—Selig Altschul



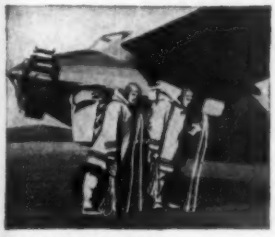
WRIGHT BROTHERS

ADMIRAL BYRD

LINDBERGH

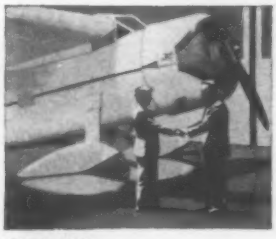
AMELIA EARHART

FIRST WITH THE FAMOUS



SIR HUBERT WILKINS

KINGSFORD SMITH



WILEY POST

JOE DE BONA

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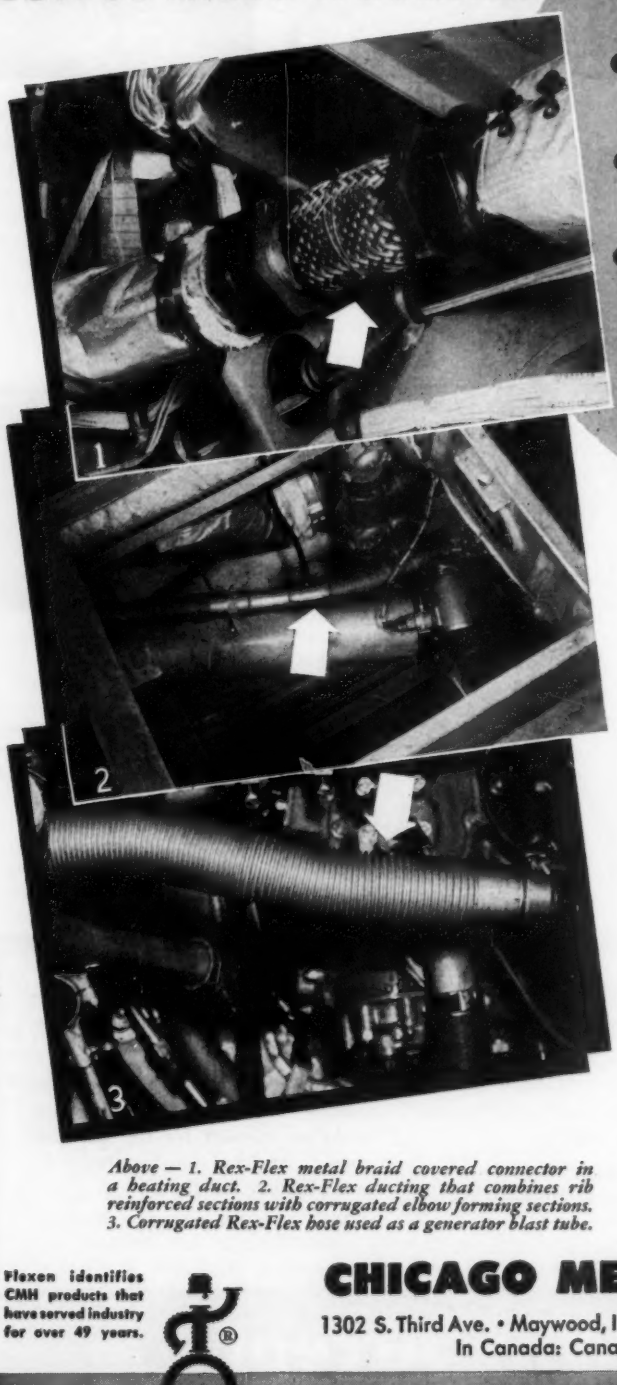
solves these troublesome connection problems



- VIBRATION
- MISALIGNMENT
- FLEXATION
- EXPANSION and CONTRACTION

Above — 1. Rex-Flex metal braid covered connector in a heating duct. 2. Rex-Flex ducting that combines rib reinforced sections with corrugated elbow forming sections. 3. Corrugated Rex-Flex hose used as a generator blast tube.

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Refined Design Puts More Power in J-47

Better ways to handle greater amounts of air are features of -21.

General Electric's new high-power jet—the J-47-GE-21—is a good example of air section engineering refinement for attainment of higher thrust.

Though this engine is officially labeled as one of the advanced J-47 series (AVIATION WEEK June 18), it is essentially in a different category mainly because of its new compressor design, no details of which have been released.

But other noticeable features are adjustable inlet vanes, and the nose section cleanup for a greater unblocked air handling area.

The use of adjustable inlet guide vanes is an indication of the increasing problems facing jet designers in the mounting tempo towards higher compression ratios.

This adjustment feature may be advantageous for one turbojet and prove of no worth in another. Wright Aeronautical Corp. has tried it out on the Sapphire in test runs and has not found it particularly desirable. Obviously GE has established its need as a compressor adjunct on the -21.

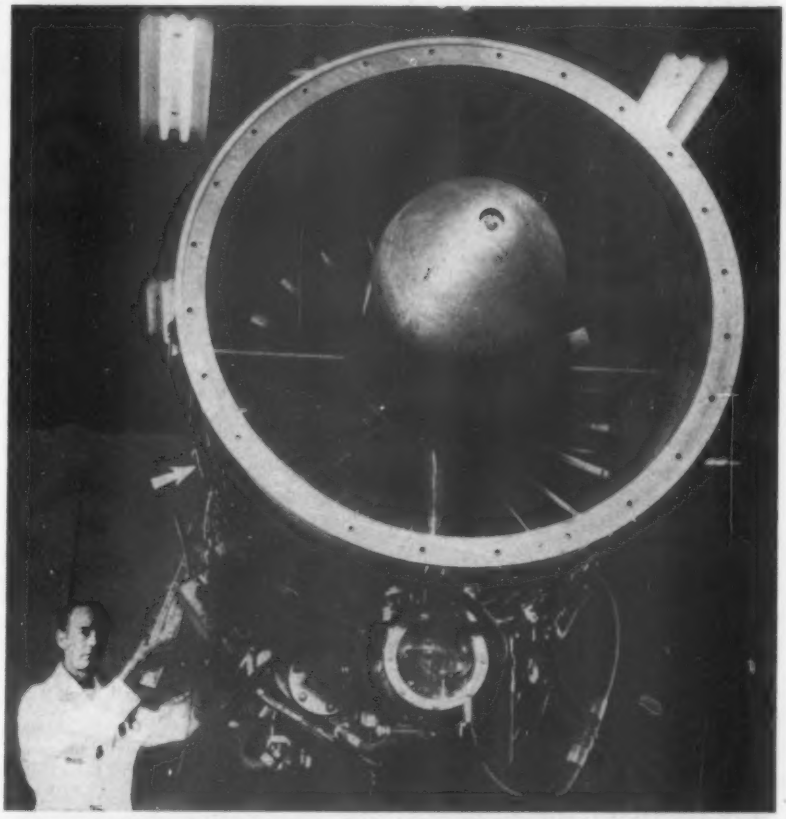
▶**Adjustment Factors**—GE technicians won't volunteer the reason for inclusion of the adjustable inlet vanes in the -21, but one interpretation could be that their use is to eliminate a possible surge condition, particularly in sudden acceleration, which might result in destructive vibration. This condition is especially true of turbojets with high compression ratios.

Mechanical reason for this is that at comparatively low speeds the air entering the compressor hits the longest blades (first few rows) at their worst (stall) angle. Hence, the object of adjusting the inlet vanes is to change the angle of the incoming air flow.

The surge condition probably is pronounced during starting and warm-up, but could also occur during high operational speeds with a sudden sharp acceleration.

The inlet guide vanes are pivoted at each end and actuated by a series of small push rods that run around the outside of the engine shell just over the vanes. Actuation of the vanes apparently is manual. Icing would seem to be a considerable factor; hence must be heated in some manner.

The new J-47-GE-21 has the same frame size as the predecessor J-47—36.75 in. in diameter, 146 in. long—but some component sections undoubtedly vary in specific dimensions.



ADJUSTABLE INLET VANES on new GE jet are actuated by pushrod (arrow) system on casing circumference. Nose section is cleaned up with accessories slung below.

▶**Dimensions**—Here are approximate figures for the new powerplant, which should push out better than 9000 lb. thrust.

- Compressor tip diameter—32 in.
- First stage compressor blade height—8⅝ in.
- Compressor section length—33½ in.
- Diffuser length—19 in.
- Cannular combustion chamber length, including tapered transition section from individual liners—30 in.
- Turbine section length—12 in. The appearance of this casing section, coupled with the thrust potential, indicates that there are two turbine wheels.
- Turbine blade height—5⅜ in.

▶**Accessories**—Struts between tailcone and bullet are double heavy gage sheet metal with spaced corrugations. This construction has been found to give high fatigue resistance.

Accessories are slung underneath the compressor shell. This arrangement not only cleans up the nose and allows more clear area for air flow, but also promotes easier accessory servicing.

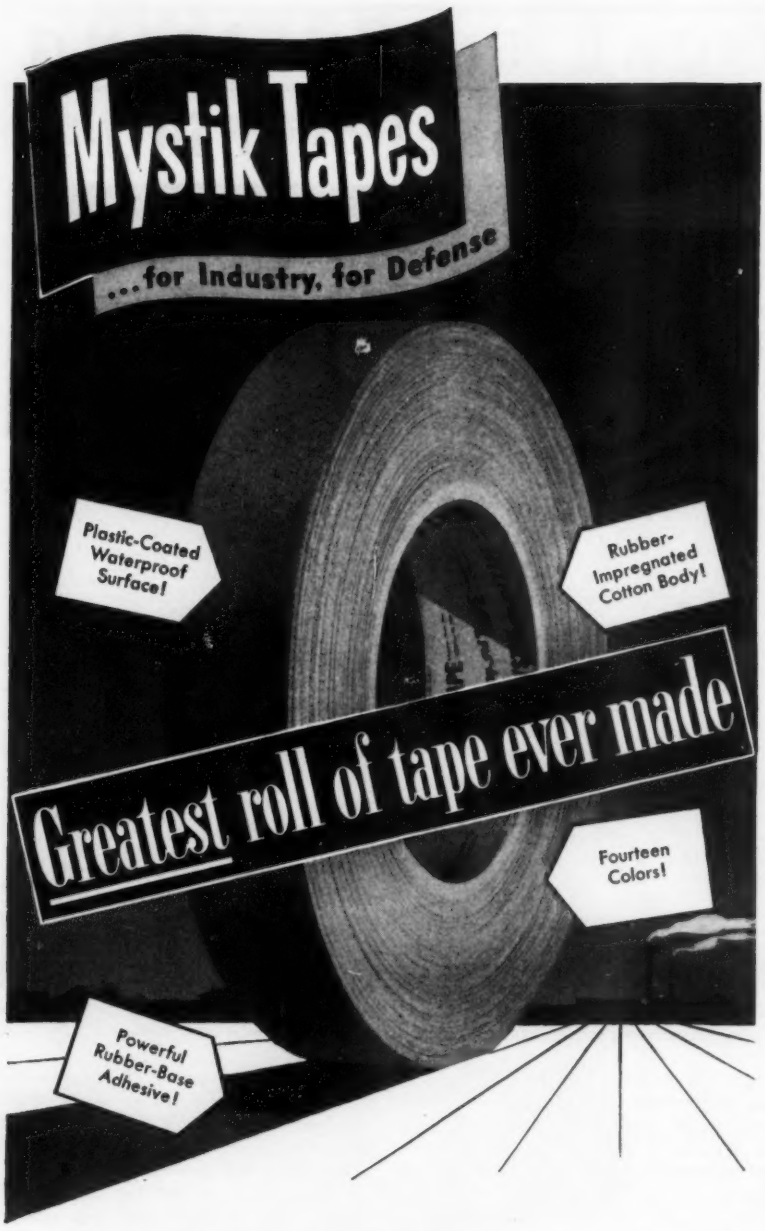
In the front, a fuel regulator is followed by a kidney-shaped gear case, a lube pump and starter-generator.

There is a place for an integral oil tank on the bottom of the engine forward. Oil cooling is by engine fuel—a system GE finds very satisfactory.

The first -21 was brought to test within 10 months from the time the design was laid down, and within 18 months from this start completed its 50-hour tests.

The engine is not yet in production, but a number have already been built. The production runs should not be too far away.

▶**What Planes?**—Because the -21 was developed primarily to fit the same diameter as the present J-47s, it can be expected that this engine will replace others in GE-powered jet planes as



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This roll of MYSTIK Tape (type 5800 C) leads the line of cloth tapes that supplied 65% of total needs of industry and the armed forces during World War II. Today, MYSTIK Tapes again are meeting the enormous protective shipping problems of military supply. Write for information and samples on the complete line of pressure-sensitive MYSTIK Tapes to meet every protective and production need. Mystik Adhesive Products, 2643 N. Kildare, Chicago 39.

soon as a switch is feasible—depending on whether there is a definite need for more power in the specific plane.

Latest version of North American's Sabre—the F-86H—might be a promising candidate, and because it is a fighter, the added speed the -21 could afford would be vitally important.

Engines for future models of Boeing's B-47 are somewhat in doubt. Installation of Allison's J-35-A-23 in the B-47C has been reported postponed in order not to upset the production program for the B-47B version. But if circumstances suddenly require use of a more powerful engine, GE's jet could be chosen if its thrust figure betters those then available.

Convair's B-36 is another possible receptacle for the new engine, in auxiliary pod units, but it is unlikely that this plane could use any more jet power than it now has.

Martin's XB-51 would be another good trial vehicle for the engine because, if the plane is ordered for production, no doubt higher-power engines will be installed.

Republic's XF-91 is another speedster where the -21 would fit. Now reported undergoing trials with a J-47 and a four-cylinder Reaction Motors rocket plant installation, it is easily understandable that for its basic jet powerplant it could take a more powerful unit without exceeding the structural limitations of the plane.

Boeing Seeks Market For Its Computers

Boeing Airplane Co., Seattle, has decided to circularize 500 research organizations to determine the sales potential of the Boeing-developed electronic analog computer. Nine of the units have already been sold at $5,750 each.

Boeing has had ten computers in use for the past year in its aerodynamics, mechanical equipment, powerplant, structures and acoustics-electrical departments. Nine more are under construction for Boeing use.

Outside orders for the computers have been placed by Bell Aircraft, North American Aviation, Lear, Inc., Lockheed Aircraft Corp., and the applied physics laboratory of Johns Hopkins University.

Boeing's computer costs several thousand dollars less than comparable computers and is said by the company to be more versatile. It duplicates in electric voltages the possible motions of the system under investigation. Lysle A. Wood, Boeing chief engineer, has predicted the computer will become a companion instrument to the slide rule and desk calculator for engineers dealing in problems of dynamics.

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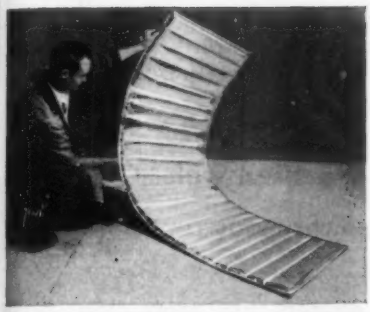
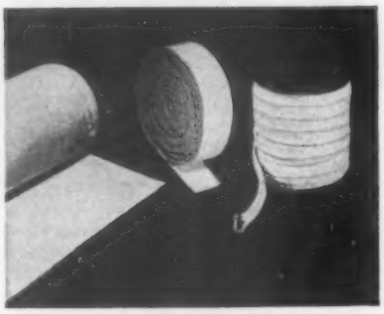
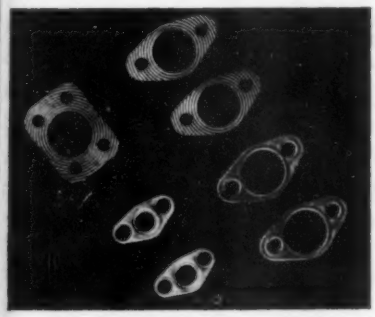


It tells about the new Johns-Manville Thermoflex* Blanket with its lightweight RF-300 Felt—the improved blanket type insulation for jet engine exhaust systems and aircraft and powerplant assemblies. *Reg. U. S. Pat. Off.

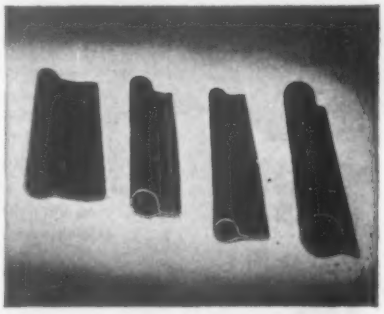
It gives you facts about J-M Asbestos Textiles designed for insulating and fireproofing aircraft structures and their component parts, exhaust-system shrouds, and fuel, lubrication and hydraulic lines.





It describes the many special types of Goetze Metallic Gaskets—such as these afterburner igniter gaskets—fabricated by Johns-Manville in almost any size or shape to meet the hot-gas sealing requirements of jet engines.

It illustrates J-M Tadpole Tapes, the special firewall gasketing tapes for sealing combustion chamber inlets, engine mounting rings, turbine flanges and other high-temperature zones in jet-powered aircraft.



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Solar Aircraft Welds Close to the Edge

Material does not split out, spattering is reduced on this jet engine part because G-E slope control permits a gradual increase in welding current that also reduces tip pick-up and spatter. More welds can be made before electrodes must be cleaned. Welds are sound and uniform. Bulletin GEC-534.

G-E Slope Control for Resistance Welding Prevents Split-outs on Stainless Steel Jet Engine Parts

More precise work possible with this resistance welding accessory used with G-E synchronous control.

Solar Aircraft, like many other plants working on jet engines, has found G-E synchronous control, with slope control added, will enable operators to work to closer tolerances, produce faster, with fewer rejects. The part shown is welded close to the edge but does not split out, and spatter is reduced on both stainless and mild steel.

Use G-E Synchronous Control wherever AN-W-30 and 32 specifications must be met. It assures consistently uniform high quality welds—operates quietly, requires little maintenance. Like all G-E electronic equipment, it has long life, is enclosed in a compact unit that may be mounted on the welding machine or wherever convenient. Easily inspected. Write today for Bulletin GEA-4699. *General Electric Company, Schenectady, N. Y.*

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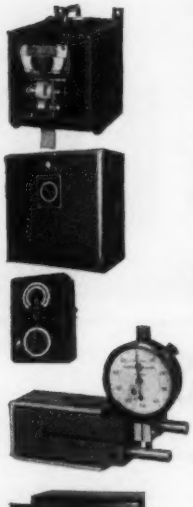

DETERMINE THE BEST TIMING FOR A JOB **Portable, inkless G-E cycle recorder makes a record of the exact timing on test welds, is then used as a check to verify the setting on machines in production. Bulletin GEC-376.**

HOLD WELDING CURRENT CONSTANT **Regardless of line-voltage variations of as much as plus 10 per cent and minus 20 per cent, the G-E electronic voltage-regulating compensator holds welding current constant. Bulletin GEA-4223.**

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MEASURE ELECTRODE FORCE **Check existing gages on spot, seam, or projection welders or at time of set up. Easy to use, saves time, acts as a production check. Force range: 0 to 4500 pounds. Small, portable. Bulletin GEA-3628B.**

PREVENT CURRENT VARIATIONS **Where the insertion of magnetic material in the throat of the welding machine causes weld variations, the current-regulating compensator keeps current constant to within plus or minus two percent. Bulletin GEA-4207.**

GENERAL ELECTRIC

645-54

ARIEL III shows clean lines in this proving flight. Turbine exhaust may be deflected by pedal action for rudder control.

Jet Copter

French machine uses turbine engine to feed air to rotor-tip ramjets.

(McGraw-Hill World News)

France's postwar aviation comeback has caught up with the latest refinements in jet power schemes for helicopters.

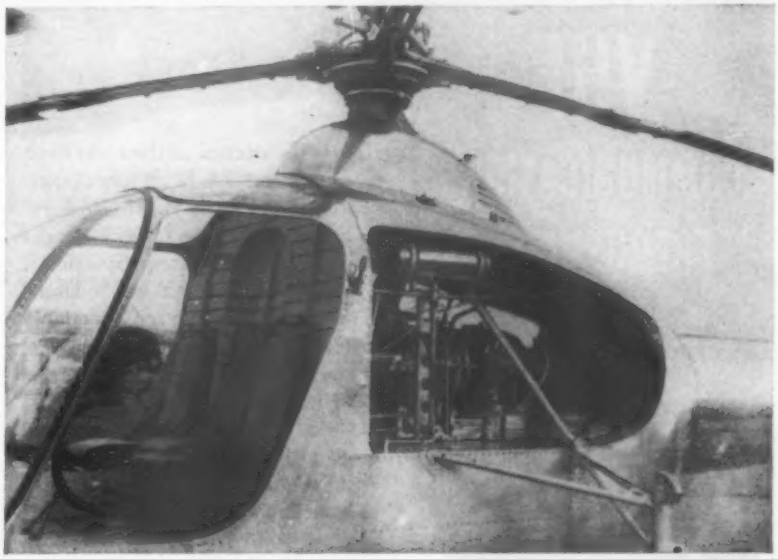
SNCASO (Societe Nationale de Constructions Aeronautiques du Sud-Ouest) has gone one step further on the plan used in the jet-propelled S.O. 1110 Ariel II by substituting a 216-hp. turbine powerplant for the 220-hp. Mathis piston engine. This drives the compressor feeding the rotor tip combustors with air in the succeeding version, the S.O. 1020 Ariel III.

▶**Recent First Flight**—The Ariel III, a clean, well-planned configuration, took to the air for free-flight Apr. 18, just a little more than one year after it received its initial run-up test. Reports are that performance trials at Villacoublay have been satisfactory.

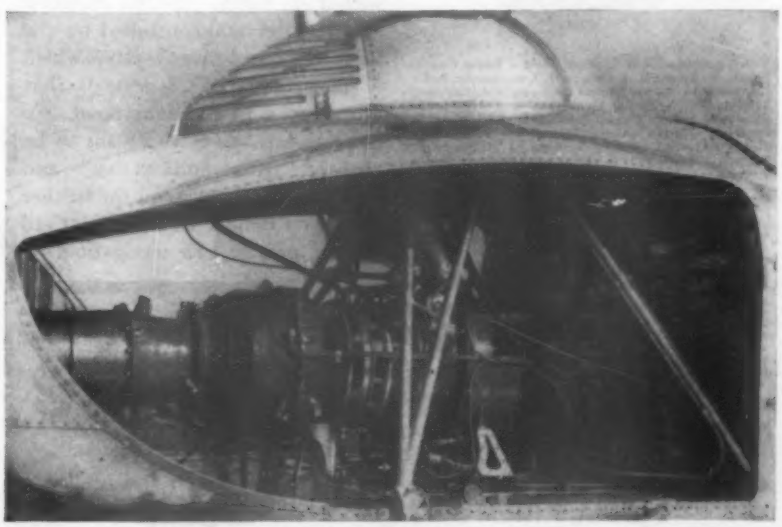
This tip-jet copter, intended as a general purpose type, is under study by the French Air Ministry. Cockpit accommodates three seats side-by-side with dual controls at the outside positions. The greenhouse tapers smoothly into the skin covering the turbine and compressor section, which is boomed aft to carry the turbine exhaust. The tricycle gear has identical shock struts. Rotor diameter is 35 ft. 5 in.

▶**Power Scheme**—The fuselage-housed turbojet is a Turbomeca Artouste which direct-drives a feed compressor from which air is piped through the rotor hub and blades out to the tip combustors where the fuel is injected.

For rudder control in low speed and hovering flight the residual exhaust from the turbine may be deflected to



ROOMY COCKPIT accommodates three, with controls at each outside seat. Residual thrust from turbine is tailpiped through boom.



ENGINE BAY is spacious and uncluttered for easy accessibility to turbine-compressor unit (right) and feed compressor (left) supplying rotor tip combustors.

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ROTOR HUB installation is clean. Tip combustor is visible at blade-end (top left).

the left or right by means of rudder pedal action.

► **What It Can Do**—Fuel consumption for the Ariel III is reported to be about three times that of conventional copters. At a cruising speed of 84 mph., range is 155 mi. with a useful load of 662 lb. For a 62-mi. range, it can tote 992 lb.

Hovering ceiling is 5,905 ft.; vertical takeoff limit, 8,530 ft.; service ceiling in translational flight, 14,436 ft.

A second prototype of the Ariel III, now under construction, will be fitted with the same type of jet plant with its takeoff rating upped to 272 hp., and no change in weight or size.

► **Convertiplane Planned**—SNCASO engineers also are pushing the design of a convertiplane—the S.O. 1300. This will also have a turbo-compressor unit to supply air for rotor tip combustors for copter flight, and drive propellers for translational flight.

Lifting force will be supplied mainly by a fixed wing, and also by the autorotational action of the rotors.

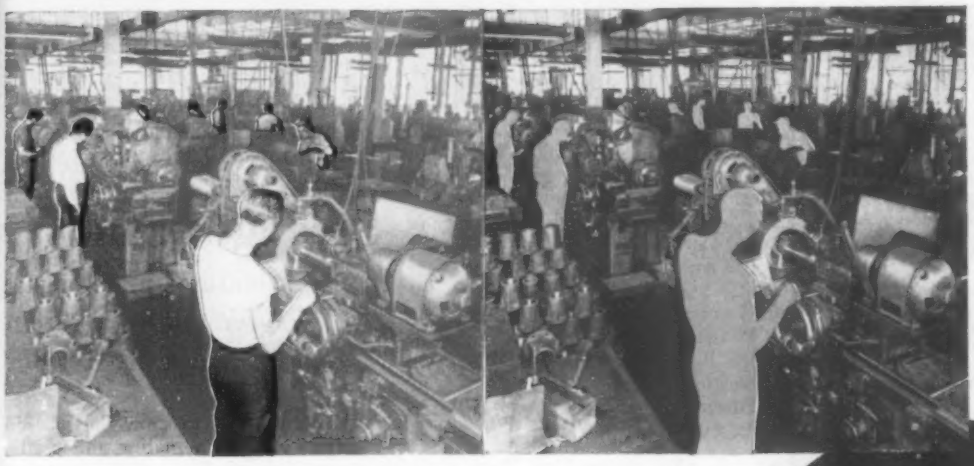
New Electronic Counting Unit

The measurement of events occurring in a desired interval of time can be accomplished through the use of the Walkirt Type M 1731 Eventometer, a new and flexible instrument developed by the Walkirt Co., Culver City, Calif.

The instrument uses counting techniques throughout and is entirely electronic in operation.

The Eventometer contains two counting systems. The first is the time base chain, which provides the time datum for counting and deter-

the SKILL *the* FACILITIES



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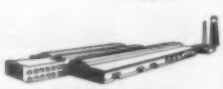
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mines the interval during which the input is counted.

The second is the counter chain and counts the unknown input.

Display of the number of cycles received during the scan time is shown by means of illuminated lights, mounted in five columns of ten lights. The read time is adjustable from a minimum value of about 0.5 sec. to over 5.0 sec. This is to allow latitude of adjustment for photography or for individual preference.

The Eventometer is designed to count any signal, in the frequency range from 10 cps. to 150,000 cps., which has an amplitude in excess of 0.05 volts but less than 100 v.

Physical size of the instrument is 25 in. high, 21 in. wide and 13¾ deep. It weighs 95 lb.

Power requirements are 105-125 volts, 60 cps. at 310 watts.

New High-Strength Laminate Treatment

The limiting factor in using glass fiber polyester laminates as a replacement for aluminum has been the strength loss due to water absorption. The laminates lose about 40 to 50 percent of their flexural strength even though the water picked up by immersion or humidity is only one percent of the weight of the part.

► **High Strength**—Now being marketed is a new glass fiber treatment called the Garan Finish, which the process developers guarantee will hold the strength loss of plastic laminates down to 10 percent and in many cases 5 percent.

They believe the improvement will make it possible to extend the use of laminates for aircraft beyond the present applications of radomes and other plastic installations.

The Garan Finish is applied to the glass fiber before the resin that makes it a laminate is applied. Standard textile treating equipment can be used. Tests conducted in many laboratories have established the reproduceability of results, according to Dr. Robert Steinman, director of research of Garan Chemical Corp., the makers. In every instance the loss in strength has been limited to 10 percent or less.

A typical laminate gave a flexural strength of 65,000 psi. when dry, and 62,000 psi after being covered with water for 30 days.

The Garan Finish currently is available only by purchasing cloth by the square yard from the Garan Chemical Corp., 7213 Santa Monica Blvd., Los Angeles. But Garan intends that other commercial finishers take it over, either by direct purchase or on a royalty basis.

The finish has been approved by the Air Materiel Command, according to Steinman, and the Air Force may soon upgrade the specifications for laminated cloth. This would mean that all glass-fiber laminates must retain 90 percent of flexural strength to meet Air Force standards.

At present, the process is limited to polyester resins.

Douglas uses Garan-finished cloth to line the inside of the cargo decks on the DC-6A.

Strength Study

Chromium plate-plastic deformation relation investigated by BuAer.

A recent study to show the relation between chromium plating and plastic deformation of SAE 4130 steel has added to the data on aircraft structural materials.

This investigation, sponsored by the Navy Bureau of Aeronautics and conducted by National Bureau of Standards' technician Hugh L. Logan, covered tensile, tensile impact, bending and crushing tests of specimens prepared from rod and tubing of SAE 4130 chrome-moly heat-treated to a hardness of about 40C Rockwell before final machining.

Specimens were tested as machined, without plating; after plating to various thicknesses; and after plating and baking at temperatures up to 440C.

Result, except for the tensile impact tests, indicate that chromium plating appreciably reduces the steel's plastic deformation, but that generally the ability of plated specimens to undergo this deformation was substantially increased by baking at 100-440C.

► **Tensile Tests**—Tensile trial specimens were plated to thicknesses of .0001-.015 in. Average values for the unplated steel were: tensile strength, 187,300 psi.; yield, 175,900 psi.; 2-in. length elongation, 13 percent; ratio of specimen original area to that at beginning of fracture, 2.088.

Tensile and yield strengths dropped with increasing plate thickness until, at the .015-in. thickness, the values were about 90 percent of those for the unplated steel. And baking at 200 and 400C produced no appreciable change in values.

Plate thickness of .010 reduced the true stress at beginning of fracture to about 80 percent, and elongation and true strain at beginning of fracture to less than 60 percent of that of the unplated steel. Here, however, baking at 200 or 440C appreciably increased these values.

► **Tensile Impact Tests**—These were run

New Techniques Speed Stratojet

New techniques for drilling and boring holes in Boeing's B-47 Stratojet compression ribs are paying big dividends in time and tool savings.

For the two large end bolt holes, the operation was cut from 26 hr. and 18 tools to just over 1 hr. and 9 tools. Contributing to the drastic time saving was a scheme to work both left- and right-hand ribs in the same jig fixture to minimize set-up time.

In another operation on the compression rib—drilling and boring 13 holes for wing stiffener fittings—35 tools were required previously. Now only 7 tools are required and the job is done six times faster. Also, the old method required slip-removal bushings for each operation, with the possibility of using the wrong bushing and drilling an oversize hole. This danger has been eliminated in the new approach by using permanent press fit bushings, the size of the finished hole, as part of the jig fixture.

Responsible for these improvements are Boeing Wichita division foremen Bill Geist, shown at left in photo pointing to some of the 35 tools formerly used for the 13-hole operation, and Bob Wilburn, who indicates the 7 tools devised for the speedup.

---

at room temperature, and striking velocity was 27.8 fps.

Unplated steel elongated 15.8 percent, absorbing 464 ft.-lb. at failure, and reduction in area was 55.2 percent.

Values for the plated specimens were 93 percent, or more, of the unplated steel, and not appreciably changed by baking at temperatures up to 300C.

▶**Bend Data**—Bend tests were performed in a universal testing machine with specimens having a pre-plate diameter of .500 in., length of 10 in.

Unplated specimens could be bent as far as possible without failure, but those plated to a thickness of .015 failed after bending through an angle of about 40 deg.

But plated specimens baked at 200-440C went through angles of 70-80 deg. before failure. And moduli of rupture of plated specimens baked at these temperatures equaled that for the unplated steel.

▶**Crushing Runs**—Specimens were machined to close tolerances from heavy wall tubing and tested as machined, after plating on inside and outside to a thickness of about .010 in., and after plating (same thickness) and baking between 100-400C. Testing was to failure by compression between stationary and movable heads of a universal testing machine with load applied along tube diameter.

Plating boosted the load required to crush by a factor of about 1.2 and reduced the deformation at failure to about 9 percent of that of the unplated steel.

And baking at 200-400C increased the load for failure about 1.4 times, increasing the deformation to about 55 percent of that of the unplated steel specimen.

One theory is that hydrogen deposited with the chromium in the plating process may be a factor in reducing the amount of plastic deformation that the steel will take before fracture.

Baking of the plated material removes hydrogen and so may be expected to increase the steel's ability to withstand plastic deformation.

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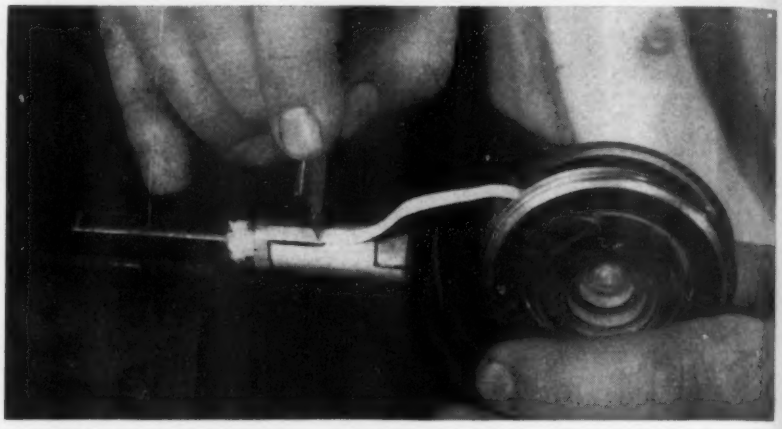
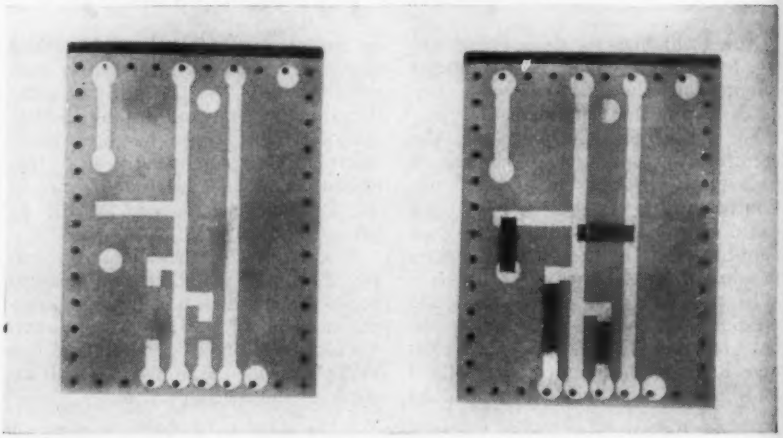


APPLYING tape resistor to miniature chassis. Tape is cut off with razor blade.



APPLIED to typical printed circuit, resistor tape shows as dark bands on circuit at right.

Resistance Tape: Use It by the Inch

New self-adhesive resistor developed by NBS is cut from spool, pressed in place on printed circuits.

Made by the yard and used by the inch, a new self-adhesive resistor has been recently developed by the National Bureau of Standards for use with printed circuitry.

With this new technique, circuits are printed in metallic bands on insulating bases, leaving gaps where resistors are specified. A length of resistor tape is then cut from a spool and pressed into position.

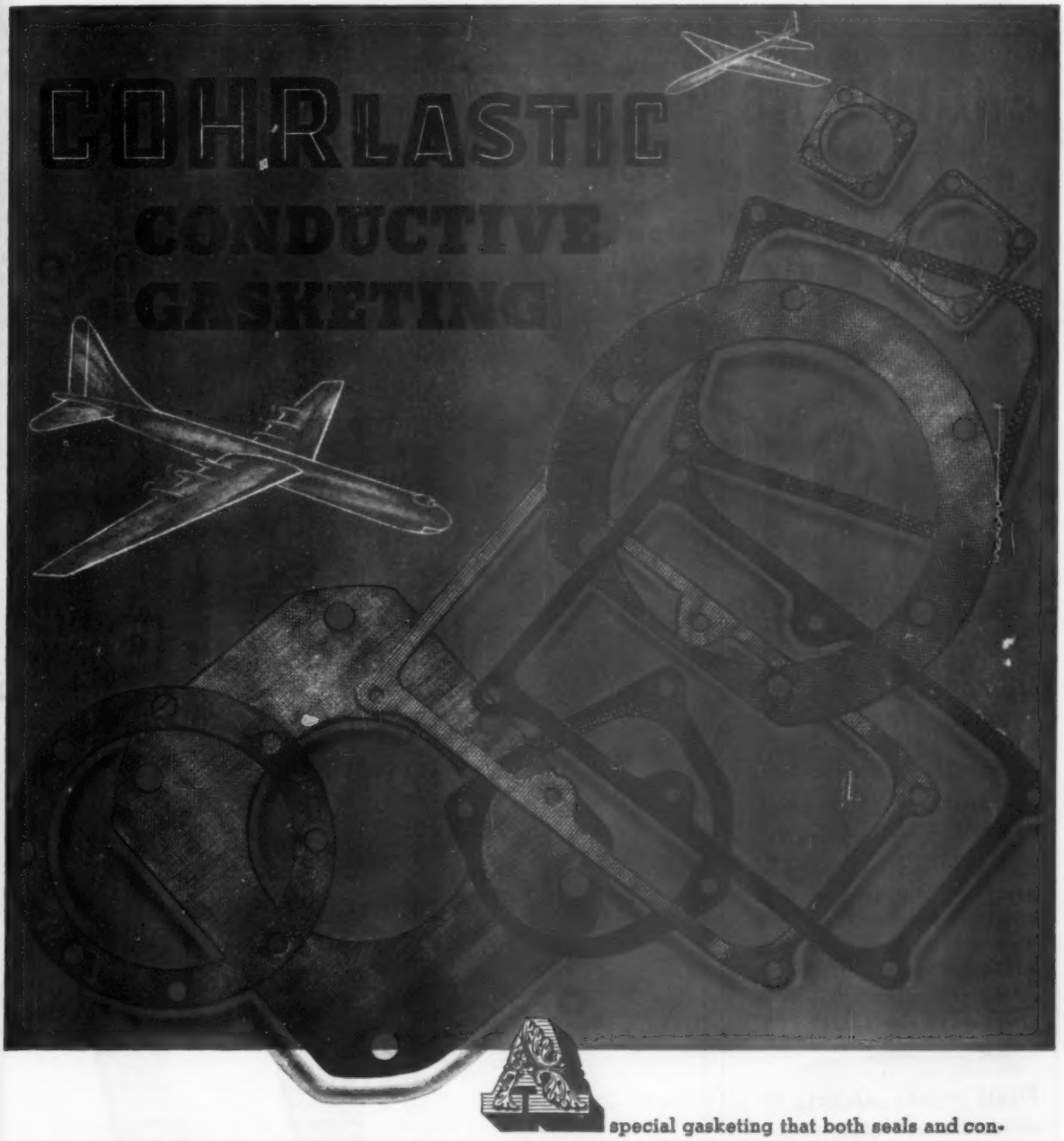
When compared with earlier techniques of printed resistors, the tape resistors show better control of resistance values and higher yields of acceptable assemblies.

► **What It Was**—Past methods for including resistors in printed circuits were painting or spraying a strip of resistance material directly on the base plate. The composition and dimensions of the material being laid on were varied to change the resistance value.

It was difficult to produce resistors to close tolerances by this method, and the reduced probability of producing a quantity of satisfactory resistors on any given assembly reduced the acceptable yield of assemblies.

The new tape resistors are a mixture of carbon black or graphite, resin and solvent applied in a thin layer to a thin roll of asbestos paper tape. The coating is sufficiently sticky to cling to an insulating base plate and to make good electrical contact with metallic terminals.

The asbestos-tape backing protects



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the resistor from electrical shorts and abrasion.

▶ **Constant Size**—Actual dimensions of the resistors are kept constant; the value of resistance is varied by a variety of coating forms. These give a range of from about 100 ohms to 10 megohms.

At one time during the development, NBS considered the possibility of varying resistor dimensions to obtain a range of resistance values. This method reduces the number of formulations needed for a complete range of resistors, but it does complicate the design of manufacturing equipment and production of the resistors.

Consequently, dimensions were standardized at a length of ½ in. and a width of 0.13 in. with a tolerance of plus or minus 0.02. This slight allowance permits some adjustment of the resistor value by splitting the tape.

Constant dimensions mean that wattage ratings are practically independent of resistance value.

▶ **Silicone Used**—The binder-adhesive is a silicone resin chosen because of its suitability for high-temperature operation. The curing temperature of silicone resin formulations is high (about 300C) and since curing is done after the resistors have been positioned in the circuit, the tape resistor is only applicable to glass or ceramic base materials at present.

The coating is sprayed on the tape in

B.H. AIRCRAFT CO. INC.

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a special cabinet and dried to some degree of stickiness with infra-red heat lamps. After spraying, the tape is slit to width. The single belt of resistance tape produces about 1500 resistors.

The tape is applied by hand from a spool to printed circuitry. It is pressed into position and cut off with a razor blade. NBS plans to develop a device similar to a wire stapler which will take a roll of the tape and apply and cut off resistor of standard length when the handle is pressed.

► **Curing Technique**—After the resistors have been applied to the circuits, curing is done. This curing hardens the resistor, bonds it more firmly to the plate and stabilizes its electrical characteristics. Optimum cure time differs considerably for different formulations, but a compromise cure of 4 hr. at 300C has been adopted as standard. Curing is done in a temperature-controlled electric furnace with an aluminum inner liner to give more uniform temperature distribution.

It has been found that use of some types of these resistors at 200C will produce sharp changes in value over the first 24-hr. period. After this, the value tends to remain stable for several hundred hours. There is, therefore, an advantage in following the cure with an aging treatment for 24 hr. at 200C. Room temperature affects the resistance value only slightly and then over a long period of time. Thus the tape may be stored for considerable time, and this storage life may be further extended by refrigeration.

► **Graphite and Carbon**—The resistor formulas include both natural and synthetic graphites and various carbon blacks. Values of resistance are changed by changing the ratio of carbon to resin in the mixture and by using different carbons. The proportion of carbon to resin ranges from 10 to 50 percent; leaner mixtures give less favorable characteristics.

Graphite mixtures have proven remarkably stable at ambient temperatures of 200C. And another advantage of the graphite formulas is that unusually low values—down to about 100 ohms—can be obtained. But the useful upper limit of the graphite tapes seems to be about 5000 ohms.

The resistance range of the carbon blacks is from 5000 ohms to 10 megohms. But only a few carbon blacks have been found to yield tape resistors which are satisfactory at 200C. However, carbon black tapes have been made which are satisfactory at 170C for most resistance ranges.

This new method of tape resistors was developed as part of a program of electronics research and development sponsored by the U. S. Navy's Bureau of Aeronautics at the Bureau of Standards.

Radio Engineers Form New Avionics Group

A Professional Airborne Electronics Group was formed within the Institute of Radio Engineers at its second annual airborne electronics conference at Dayton recently. John E. Keto, a Wright-Patterson AFB electronics sub-division engineer, was named first head of the new group.

The three-day affair attracted more than 1,400 of the nation's top electronics scientists and engineers.

The importance of radar, radio and other electronic wonders, and the role each plays in aviation in peace and war, were presented in the more than 74 technical papers which were heard at the conference.

Function of the new airborne group will be to "promote the exchange of technical information in the field of airborne electronics." Plans include publication of a special technical journal to disseminate technical reports from all over the world. The new organization would accept members in every country.

In addition the group plans to hold a series of symposiums and conferences in various sections of the country to bring together as much of the technical know-how as it can. Conventions are scheduled for Houston, Los Angeles and New York.

During the conference at Dayton more than 75 companies engaged in the aircraft electronics field presented exhibits, including working models of some of the latest monitoring instruments for guided missile flight.

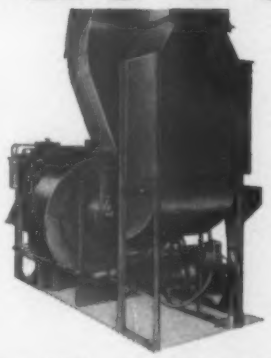
Speakers included Dr. Harold B. Richmond of the General Radio Corp. and Maj. Gen. H. McClelland, communications and electronics advisor for the Joint Chiefs of Staff in Washington. General McClelland was honored for his pioneer work in establishing the world-wide Air Force communications system.

Dayton was selected as a traditional site for the annual airborne conference because of the nearness to facilities at Wright Field.

In speaking to the group General McClelland disclosed that he believed "other nations were equal to us in technical achievement in the electronics development for aircraft and in some cases they might be ahead of us." He didn't mention Russia but he implied the Soviet has some highly advanced equipment.

Referring to guided missiles and "push-button techniques" the general said that "astonishing improvements have been made in refinements of radar and other control and guidance means that put the layman's conception of this type of warfare much closer."

SAND & DUST TESTS



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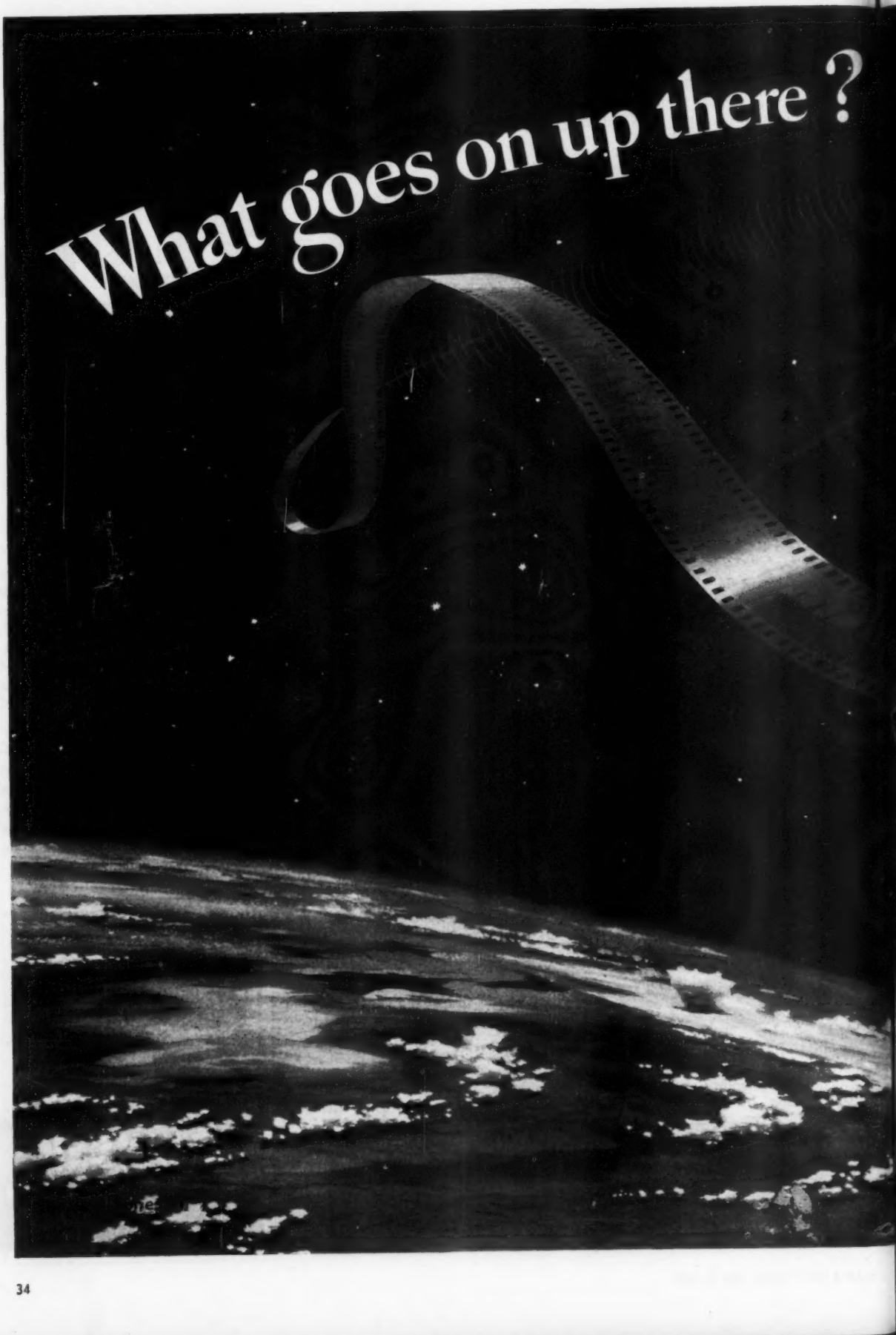
What goes on up there ?

Highest and fastest flight ever attained by any known rocket was that achieved by the "Wac Corporal" on February 25, 1949. The "Wac" was fired from a larger "bumper" rocket miles above the earth's surface. Structural design of the "bumper" and construction of the "Wac" were among the contributions made by Douglas. But designing and building such missiles is only part of the job. Gathering and computing data secured by test flights is also vital. One of many examples of how Douglas is helping to pioneer this work is the new Automatic Data Analyzer. Developed for Army Ordnance, this machine converts coded photographic recordings, such as radio-transmitted missile data, into a flow of interpreted information from instruments to the engineers. In this important field of research analysis and application, as in many other activities in the aircraft and related industries, Douglas continues to make significant advances.

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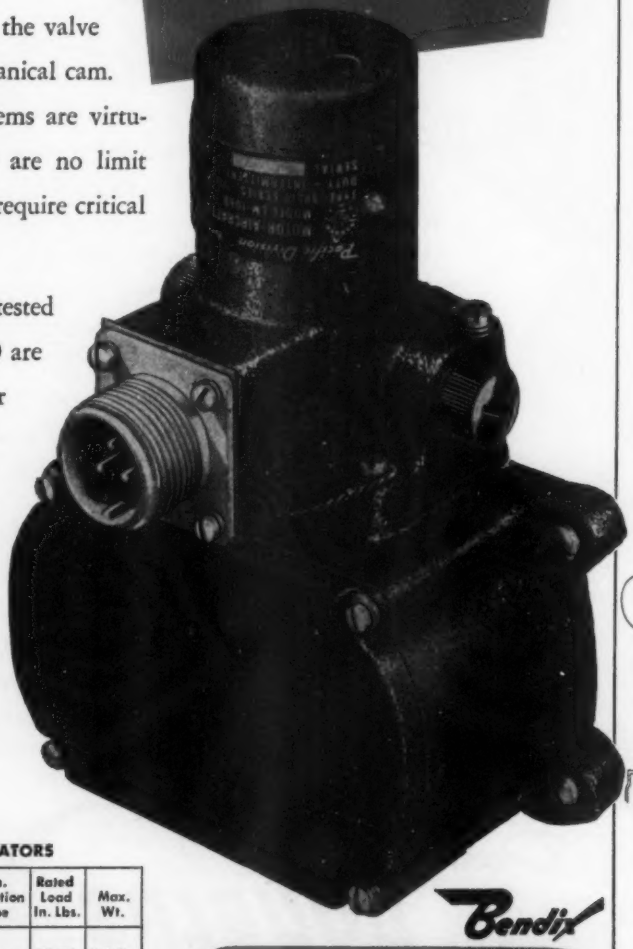
Geneva-loc Actuators position the valve by means of an accurate mechanical cam. Installation and service problems are virtually eliminated because there are no limit switches or clutch brakes that require critical adjustments.

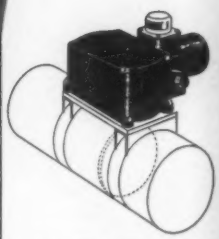
Geneva-loc Actuators are time-tested equipment – more than 15,000 are in service. Solve your actuator problem by specifying the Geneva-loc Actuator which is currently in volume production by one of the oldest and largest aircraft component manufacturers and be assured of a reliable source of supply in the years ahead. Write for Bulletin BA 107.



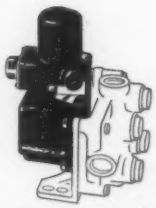
GENEVA-LOC ACTUATORS

Series	Positioning	Min. Actuation Time	Rated Load In. Lbs.	Max. Wt.
LM108	2- to 8- position 90°, 72°, 60°, 45°	1.25 sec.	30-70	2.0 lb.
LM118	2-position 90° only Currently available	.8 sec.	45	1.1 lb.

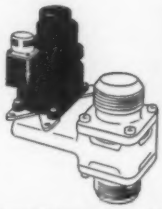
Filtered models (-4) are also available for installations requiring the maximum in radio noise elimination.



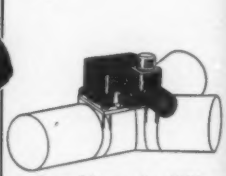
4 position series 108 as an air valve actuator



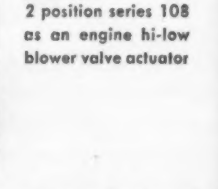
3 position series 108 as a hydraulic valve actuator



2 position series 118 as a gate valve actuator



8 position series 108 as a mixing valve actuator



2 position series 108 as an engine hi-low blower valve actuator

Bendix

Pacific Division
Bendix Aviation Corporation
NORTH HOLLYWOOD, CALIF.

East Coast Office: 475 Fifth Ave., New York 17 • Export Division: Bendix International, 72 Fifth Ave., New York 11 • Canadian Distrib.: Aviation Electric, Ltd., Montreal

PRODUCTION

New Types of Facilities Needed

Because their post-emergency use is very limited or non-existant, they complicate the financing problem.

By Rudolf Modley

The drive to increase the aircraft industry's facilities has created problems which have been little publicized. Reasons for this are examined in two articles, of which this is the last. The author, a frequent contributor to AVIATION WEEK, *is consultant to the Aircraft Industries Assn.*

Both government and industry want aircraft producing facilities increased. The government would like industry to supply most of the capital for the expansion. The industry would like to oblige—but present conditions make that a near impossibility.

As pointed out last week, the cost of privately financed facilities can be written off only during the five-year emergency period. If the emergency does not last five years, the manufacturer loses the tax benefit for the remaining period.

And, as an additional handicap, producers of aeronautical equipment cannot include in their prices the cost of facilities certified for accelerated depreciation.

As so often before, the aircraft industry is in a different position from most other industries. New facilities have little foreseeable post-emergency usefulness for the industry. One reason in the type of facilities now needed.

Several companies are faced with the necessity of providing additional flight testing and assemblying plant area. Jet airplanes require more runway facilities than reciprocating types. The relatively new jet engine still presents some flight hazard for thickly settled communities and the noise of the jet exhausts causes complaints from residents.

The only solution is to provide testing facilities at some more remote area where the noise is no nuisance, where the runways are longer, and the approaches better. This means removal of some of the manufacturing and flight testing operations to isolated areas and involves new construction of assembly and flight testing facilities. Thus, Grumman, for instance, has both extended its runway in Long Island and leased a flying field in Florida for flight test programs.

Some manufacturers need new office buildings. The complexities of the modern-type airplane increase the need for engineers, accountants and control personnel. These indirect workers need office space. As a result, the industry will have to construct new office buildings.

In addition, the desire of the Armed Services for dispersing aircraft production has also tended to increase the need for additional buildings.

► **Machinery Problem**—Machinery and equipment are an even more serious problem than expansion of plant facilities only.

This is due to the fact that the airplanes that are to be built are considerably more advanced and are harder to build than those in World War II. The improvements in the last ten years have doubled fighter speeds, nearly doubled operational altitudes, increased the fire-power of fighters nine-fold and bomber loads eight-fold. Further changes are occurring constantly. These constant changes require special equipment which did not exist during World War II and which exists now only to a limited extent.

An example of this is the spar mill. Lockheed, for instance, reports that in 1950 it spent $169,000 for a pair of spar mills for cutting wing beams.

Wing skins provide another example. In the wing of today's jet fighter, strength and weight factors are so critical that sheets of tapered thickness must be used. The compound taper on these sheets must be milled on special machines. One manufacturer alone spent $377,000 last year for a new skin milling machine.

Larger hydraulic presses must be added. In 1951, Lockheed added an 8,000-ton triple-action metal forming press. It cost $750,000. The largest previous one had a capacity of only 4,500 tons and cost $94,744.

Modernization of Boeing's windtunnel is to cost $1,400,000 this year.

Quantity production under larger procurement contracts will require new machinery that could not be used economically for the smaller quantities ordered in past years.

► **Working Capital Low**—All in all, it is apparent that a typical aircraft manufacturing company is faced with considerable new capital expenditures. The amount depends on the size of its program and the nature of its manufacturing and operating problems. The manner in which it will finance the expenditures depends on several other factors.

It will be hard for the individual companies to finance such expansion out of their own funds. At the end of 1950 the working capital of the average airframe manufacturer was only about $20-25 million. These funds, as in previous periods of expansion, are urgently needed. They can not be frozen into brick and mortar or machines but must be on hand to finance the expanding operations. Actually, many companies are so short of working capital that they had to increase their bank loans.

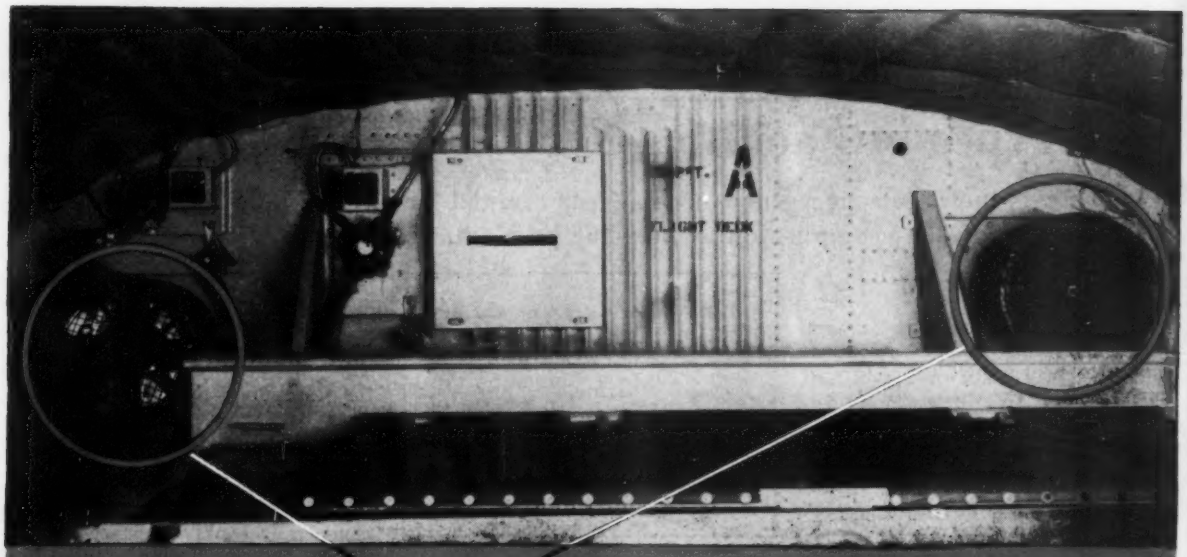
Bell, for instance, negotiated a $25-million Regulation V Loan from ten commercial banks to finance its expanded backlog. Boeing arranged lines of credit aggregating $30 million in October, 1950. Convair maintains the ability to borrow up to $20 million and Douglas has entered into a tentative credit arrangement with five banks in order to facilitate the financing of further increases in receivables and inventories. Lockheed, too, expects that the larger production scheduled will necessitate additional working capital. Martin has credit commitments of $18 million from the RFC and a bank, and Republic has a credit not to exceed $5 million waiting at the Chase National Bank.

While most manufacturers are willing and able to invest some of their own money, it is obvious that they cannot finance the needed facilities expansion without more help than now provided.

Other industries may expect to return to peacetime production to meet a considerable pent-up demand. They may, therefore, expect continued profitable operations which should enable them to meet any remaining amortization payments.

The aircraft industry is in an entirely different position. The experience after both World Wars proved that the industry loses very heavily after each war. After World War I, the industry was practically wiped out. And the losses in 1946 and 1947 for the 12 major airframe manufacturers amounted to $52.6 million. There is little reason to believe that the situation will be different when the present emergency is over.

Only a shortening of the five-year amortization period into the emergency period (if the emergency should be shorter) and full reflection of the cost of facilities in prices during this period will provide the necessary incentive to private funds to invest in aircraft facilities.



JOY® AXIVANE® AIRCRAFT FANS

ELIMINATE DANGEROUS FUMES

The Douglas C-124A Globemaster II, designed and manufactured by the Douglas Aircraft Company, Inc., Long Beach, California, is designed to permit trucks to be driven directly into the cargo department for loading or unloading. Exhaust gases from gasoline or Diesel-driven trucks would present a hazard to the loading crew. Two Joy AXIVANE Aircraft Fans are therefore installed in the forward cargo-compartment bulkhead. These introduce a large volume of outside air into the cabin, during loading operations, to prevent the accumulation of explosive or toxic vapors. When the plane is transporting troops, these fans provide ventilating air prior to take-off.

Each of these highly-efficient .6 H.P. blowers produces 1280 C.F.M. at 2.0" static pressure, yet weighs only 15.5 pounds and is only 9" in diameter. Distinctive advantages found in all Joy Aircraft Fans are compact design, shock-resistant strength, minimum operating noise, and the most favorable air volume-to-weight and electric-to-air power ratios.

W&D A3441

● Joy designs and builds each fan to the exact requirements for which it is intended. Each fan, therefore, is custom-engineered for highest efficiency. For many purposes stock fans can be supplied from the extensive line already designed. Both single and two-stage units available. Optional features include straight or flared inlets, beaded or flanged connections, radio noise-filters, anodization, and cooled motors where required.

★ ★ ★ ★ ★

Here are some of the many uses for Joy AXIVANE Aircraft Fans: Windshield de-frosting, windshield or wing de-icing, cabin heating, cabin ventilating, cockpit heating, cooling radio and electronic equipment, cooling voltage regulators, oil cooling, gear-box cooling, instrument cooling, air recirculation, and high-altitude pressurizer boosting.

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GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

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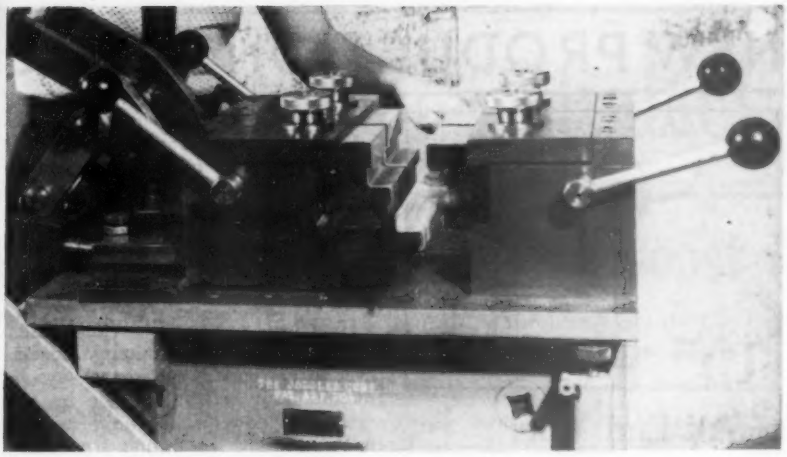


Joggling Along On Convair B-36 Tooling

A comparatively inexpensive manual joggle machine has been developed by Consolidated Vultee Aircraft Corp.'s Ft. Worth division to ease tooling problems in its B-36 subcontracting.

When Convair expanded its subcontracting on the huge bomber last year it found that none of the subcontract prospects had any type of joggle machine. To avoid authorizing the fabrication of expensive tools, Convair put its top tool technicians to work to design a manual joggler for limited quantity production. They came up with a scheme that was subsequently modified to permit mass production on an economical basis.

▶ **Casting Easy**—The resultant machine, capable of performing compound joggles, has a stationary plate and a movable plate carrying like sets of jaw holders. The movable plate is operated by a hand lever through a selector which can be positioned to any of the four cardinal directions.

The joggling jaws are cast from Cerrotru in an inexpensive molder. A section of the part to be joggled is clamped in position in the molding machine and the casting alloy poured around it. After cooling, the casting is bandsawed in quarters and the section of material serving as a model is removed.

▶ **Quick Setup**—The four parts of the bandsawed casting are ready to serve as jaws when given a relief radius in the direction of the joggle, then set in the machine at the desired spacing to give the joggle required.

Convair reports that changeover from joggling one type of section to another requires only 34 min., including the casting of the new set of jaws.

Pilot model of the machine is producing joggled parts for the B-36 at the rate of three a minute.

Intercontinental Mfg. Co., Garland, Tex., has been licensed to build the joggler.

Our Expanding Industry . . .

Goodyear Aircraft Corp., Litchfield Park, Ariz., has been awarded a multi-million dollar contract by North American Aviation to build complete wing and tail assemblies for the T-28 trainer. Contract will run through 1952. . . .

Ryan Aeronautical Corp., San Diego, Calif., has received a multi-million dollar contract to make aerial refueling pods for Boeing KC-97 tankers. The contract runs through 1952. . . .

Cessna Aircraft Co., Wichita, has received additional contracts amounting to several millions of dollars from Boeing-Wichita for B-47 tail assemblies. . . .

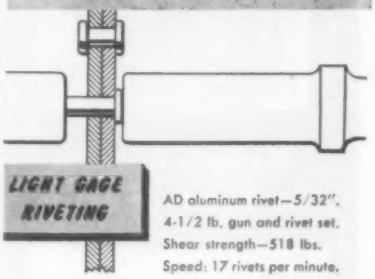
Douglas Aircraft Co. has started a $16-million expansion program of its El Segundo division, which will increase space from 1.6 million sq. ft. to 2.6 million sq. ft. Approximately $8-million worth of new production machinery and equipment will go into the expansion. . . .

Fairchild Engine & Airplane Corp. has purchased 25 acres of land approximately two miles north of the corporate limits of Hagerstown, Md., for a new office building. The Guided Missiles division has broken ground at Wyandanch, L. I., N. Y., for a new $1,750,000 plant which will develop and produce missiles.

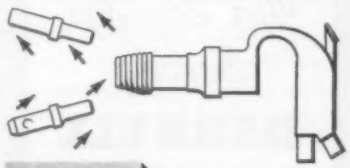
RIVET PROBLEM—
Change in light material gages to heavy gages—light loads to heavy loads.

METHOD—
What fastener?
What tools?
How much time?

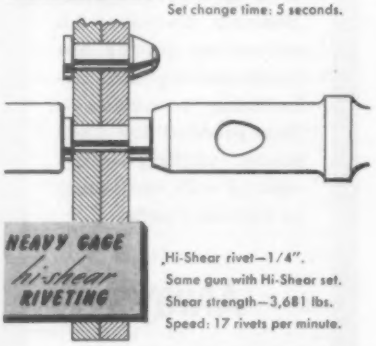
SOLUTION—
hi-shear rivets!



LIGHT GAGE RIVETING
AD aluminum rivet—5/32".
4-1/2 lb. gun and rivet set.
Shear strength—518 lbs.
Speed: 17 rivets per minute.



TOOL CHANGE
Use same gun.
Remove rivet set.
Insert Hi-Shear set.
Set change time: 5 seconds.



HEAVY GAGE hi-shear RIVETING
Hi-Shear rivet—1/4".
Same gun with Hi-Shear set.
Shear strength—3,681 lbs.
Speed: 17 rivets per minute.

Hi-Shears permit the use of smaller and lighter riveting equipment . . . hence, more speed and less worker fatigue. Since Hi-Shear riveting is accomplished with standard riveting guns and squeezers, no expensive pullers or special single-purpose equipment is necessary.

U. S. and foreign patents — Trademark registered.

THE hi-shear RIVET TOOL CO.
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for any type of use

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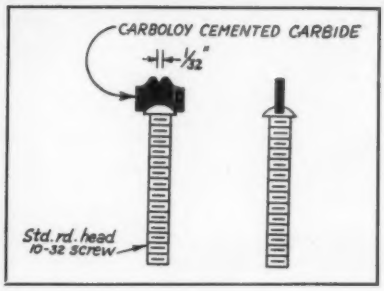
NEW PRODUCTION TOOLS



Small End Mills

Perhaps a simple method of making small end mills worked out by General Electric Co. could be used to advantage in your machine shop.

The company simply has taken standard Carboloy 883 blanks and brazed them into the head slots of 10/32-in. roundhead screws. Blanks then are ground to shape and end mill is finished (see cut). They are used for machining oil grooves in sleeve bearings. The method is employed by GE's Small and Medium Motor divisions.

Versatile Machine

An improved single-spindle tool for drilling, milling and horizontal boring, designed to permit machining of parts at higher speeds with greater accuracy and economy, has been built by Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

A big advantage of this large machine, according to G&L, is that operator can select any of 45 spindle speeds through a range of 10 to 1,300 rpm.

The tool affords maximum machining efficiency when using carbide and cast alloy cutting tools, says the company. It adds that the machine is readily adaptable to all types of light, medium and heavy duty work.

"It is capable of solving many stubborn production problems . . . and is . . . designed to meet urgent production requirements that demand faster cutting speeds, heavier cuts, better finishes and greater accuracy . . ." says G & L. Some improvements listed for it over predecessors built by the company are:

- **Hardened ways** on bed and saddle to maintain high machining accuracy over longer periods of time. Ways are mounted on bed and saddle by new method of doweling to minimize transmittal to ways of torque strains and stresses set up by temperature change.
- **Single spindle** (4-in. dia.) of Nitralloy steel has 30-in. travel and with speeds up to 1,300 rpm. permits use of all types of carbide cutters.
- **Automatic positioning** device affords machine settings to "extremely" close limits. Predetermined settings of the machine table and headstock are mechanically controlled, eliminating time-consuming final hand adjustments in locating work. Need for special jigs and fixtures is reduced.
- **Rapid speed change** is possible with simplified gear change employing two hand cranks and operating in conjunction with direct reading dial.
- **Gears in machine** now are cut and shaved, followed by hardening, to close tolerance to minimize backlash and meet demands of higher cutting speeds and heavier loads.

TOOL BITS

Die grinding tool (air driven) is designed to solve many precision grinding problems on small dies, castings and other parts having grinding areas hard to reach with present tools. Made by Mall Tool Co., 7725 S. Chicago Ave., Chicago 19.

Three-blade hole cutters (adjustable) are specially engineered to cut clean holes $\frac{3}{8}$ to 5 in. in diameter through curved surfaces of pipes, tanks, cylinders, etc. Tool will cut through some steels up to one in. thick. Made by Robert H. Clark Co., 930 Santa Monica Blvd., Beverly Hills, Calif.

"Panalarm" signal cabinet which backlights trouble designations printed on panel face can be adapted to detect off-normal operation of almost any type of machinery, says maker, Panalarm Products Co., 7218 N. Clark St., Chicago 26.

What's doing at JACK & HEINTZ

Alternators Offer Means to Boost AC Power Output

The large amounts of AC power required by modern aircraft have led to the use of engine-mounted alternators which are high in efficiency, thereby permitting a given airplane to have available the maximum amount of AC power with the least tax on engine output. Also, commutation and brush problems inherent in DC generators at high altitude are largely avoided, since the brushes and commutators used in the alternators may be utilized at much lower current densities than would be practical on DC machines.

By using alternators to generate AC power, the total installed electrical system weight may be reduced appreciably.

In addition to engine-mounted alternators, J&H has developed machines for use with air turbine drives, hydraulic drives, or other power sources. The current J&H line of aircraft alternators ranges from 3 KVA to 312 KVA, with both constant and variable-speed machines in most ratings. We also offer tailored designs for guided missile applications involving unusual cooling conditions and operating requirements.

J&H Alternators embody many years' experience in designing for specific aircraft applications. This design experience enables us to provide a maximum of performance with a minimum of weight and space.

A representative J&H Alternator—the G90-1 Model—with a 15 KVA, 120 volt, single-phase rating.

90 Aviation Customers Served by J&H

In addition to our military customers—the Air Force, the Army and the Navy—we are listing below 90 major customers in the aviation industry who count on J&H *Rotomotive* devices to perform vital functions in their equipment.

Commercial Air Lines — Domestic	24
Commercial Air Lines — Foreign	17
Airframe Manufacturers	16
Aircraft Engine Manufacturers	6
Aviation Equipment Manufacturers	25
Research & Development Centers	2

J&H moves fast to give you working models!

In this complete model building shop in the engineering laboratory, J&H takes designs off the boards and *makes them work.* Finished parts are fabricated and checked carefully against specifications. They are then precision assembled into electrical, hydraulic or mechanical prototypes for thorough experimental testing. Individual initiative and flexibility enable J&H engineers to *get at your problem faster . . . give you the working Rotomotive prototypes you require.*

CHIEF ENGINEER'S CORNER

Many customers have asked us for quotations on special types of alternators—cascade, induction, and the like. Our company has built several models of these, gaining experience that is invaluable in determining the best type of alternator for a specific purpose.

In general, there are no "trick" machines that solve *all* of the fundamental problems we encounter. Each type of machine has its advantages and its disadvantages.

Often, we are asked to quote on a specific type of machine, but after learning more about the application, we find that another type is better suited.

Usually these situations arise from a misunderstanding of the brush problems involved at high altitude. Many advances have been made in the treatment and application of brushes, especially as applied to alternators. It is a rare occasion where we find it necessary to provide a "brushless" alternator design with its inherent disadvantages.

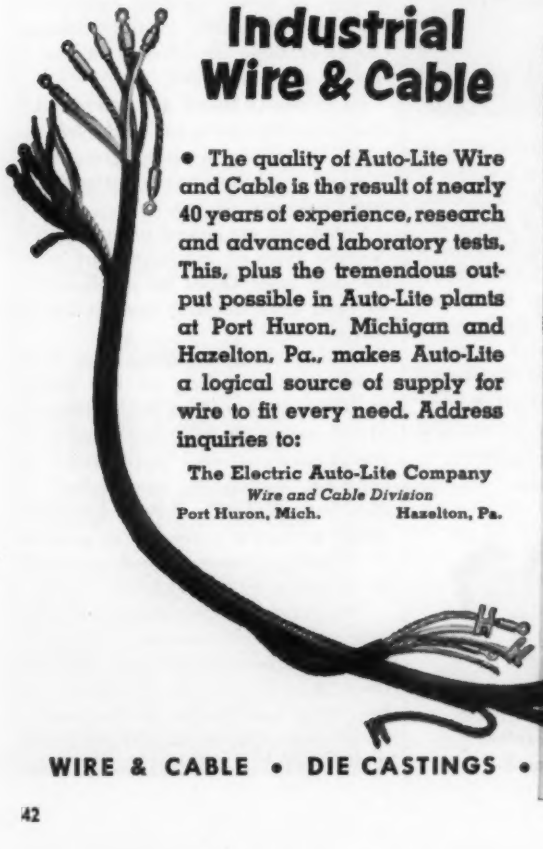
We hope our customers will provide us with a maximum of application and environment data. We will then be in a position to choose the best type and design of machine to meet your requirements. Write JACK & HEINTZ . . . Cleveland 1, Ohio.

JACK & HEINTZ *Rotomotive* EQUIPMENT

means electrical, hydraulic or mechanical devices designed to solve unusual problems of developing power, controlling it, or using it.

You're always right with AUTO-LITE

Industrial Wire & Cable



• The quality of Auto-Lite Wire and Cable is the result of nearly 40 years of experience, research and advanced laboratory tests. This, plus the tremendous output possible in Auto-Lite plants at Port Huron, Michigan and Hazelton, Pa., makes Auto-Lite a logical source of supply for wire to fit every need. Address inquiries to:

The Electric Auto-Lite Company
Wire and Cable Division
Port Huron, Mich. Hazelton, Pa.

MAGNET WIRE
Round Single and Heavy Formvar
Round Enameled and Formvar Single Cotton, Round Double Cotton
Round, Rectangular and Square Double Paper Single Cotton
Round, Rectangular and Square Vega Chromoxide
Tinned Copper Wire
AUTOMOTIVE
Ignition Cable Neoprene Sheathed
Low Tension Cable Color Combinations
Battery, Starter and Ground Cable
AIRCRAFT
Plastic Insulation—Special "B" Cotton Braid—"CA" Lacquer
APPROVED UNDER SPECIFICATION NO. AN-JC-48

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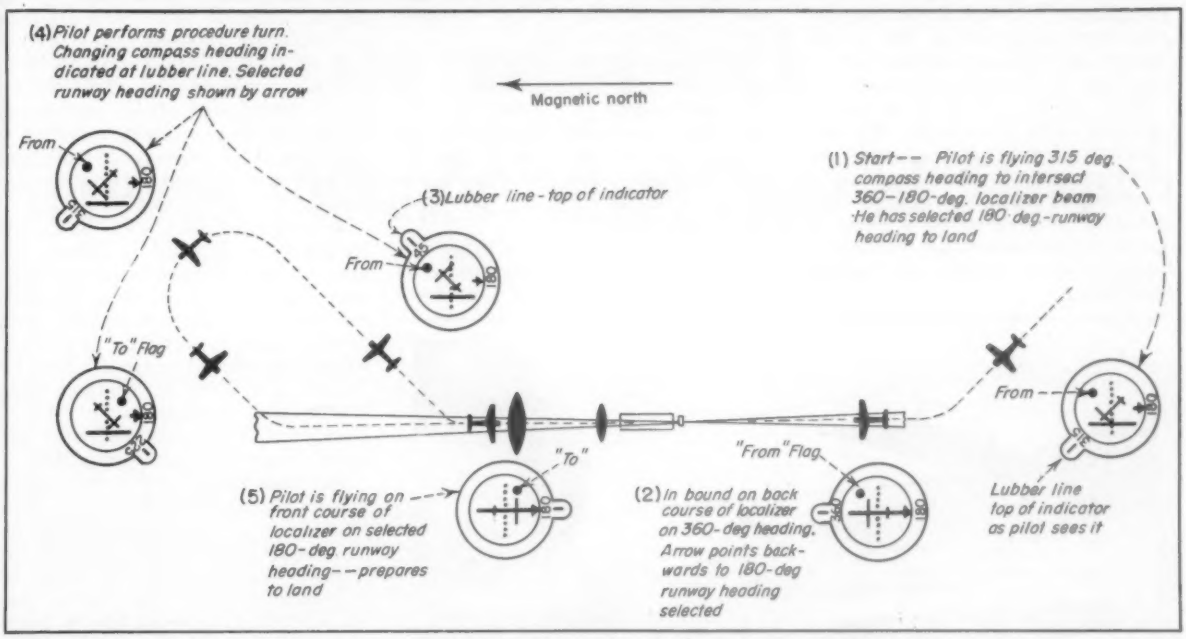

(4) Pilot performs procedure turn. Changing compass heading indicated at lubber line. Selected runway heading shown by arrow
Magnetic north
From
(3) Lubber line - top of indicator
From
(1) Start -- Pilot is flying 315 deg. compass heading to intersect 360-180-deg. localizer beam. He has selected 180-deg.-runway heading to land
"To" Flag
From
"To"
"From" Flag
(5) Pilot is flying on front course of localizer on selected 180-deg. runway heading -- prepares to land
(2) In bound on back course of localizer on 360-deg heading. Arrow points backwards to 180-deg runway heading selected
Lubber line top of indicator as pilot sees it

HOW PLANE APPROACHES runway by means of Collins Course Line Indicator is shown in this sketch.

New Picture Aid for ILS-Omnirange

Collins system graphically displays position; combines attitude and steering information in one instrument.

By Scott H. Reiniger

A major departure in design of visual aids for VHF navigation and instrument letdown is clearly shown in a promising new "picture" instrument system demonstrated recently to major airlines and AVIATION WEEK.

The airborne system is a development of Collins Radio Co. It utilizes primarily ILS and omnirange facilities, but also can be employed with other radio navigation services and for flying compass courses.

Main components of the Collins system are the "Approach-Horizon" indicator and the "Course Line Indicator." With these two panel-mounted instruments, the system gives one of the clearest presentations this reporter has seen:

- **Steering information** for flying on selected localizer, glideslope, and compass courses (provided by Approach-Horizon).
- **Rate information** for steering plane so it approaches smoothly without bracketing (asymptotically) onto selected localizer courses (provided by Approach-Horizon).
- **Attitude in bank and pitch** (duplicating artificial horizon), most specifically for instrument letdown procedures, but available for any operation (Approach-Horizon).
- **For the first time,** attitude and steering on localizer and glide-slope (rate information for localizer) combined in a single indicator (Approach-Horizon).
- **Position information** displayed in a picture showing displacement of plane and direction of flight with respect to selected omnirange and localizer courses (Course Line Indicator).
- **Compass heading** at all times and deviation in degrees (through 360-deg. scale) from selected compass, omnirange or localizer bearing (Course Line Indicator).

▶**New Features**—The Cedar Rapids firm has added ingredients to its ILS-omnirange instruments not to be found in comparable equipment now on the market. These new ingredients are:

- **Attitude information** (in bank and pitch) for ILS letdowns.
- **Full-scale** (360-deg.) compass repeater driven by gyrosyn or fluxgate compass.
- **Graphic display** of plane's displacement with respect to selected course—provided in picture which simulates in a true relationship the actual situation.

This latter point is underscored by Collins with the statement that the system "pictorially eliminates the sensing and ambiguity problems associated with the usual type of crosspointer indicator."

However, while Collins has added ingredients, the company also has decided to leave out one or two. For example, its system provides rate information for steering on localizer only, while there is equipment on the market which gives rate information both for localizer and glideslope.

The company has been touring the country with its equipment, collecting suggestions for further improvement from various airlines and other interested groups. Some modifications are expected. One most likely is reduction in body size of the Course Line Indicator to fit 3½-in. instrument panel cutouts. The 4½-in. face on the unit also may be reduced. The firm plans to have "sample" quantities available by late summer and to go into full-scale production in early 1952.

The system in its entirety consists basically of the two panel-mounted instruments including all switches, a computer amplifier and vertical gyro. While

not decided, price is expected to be about $4,000.

▶**Field Reactions**—AVIATION WEEK queries among pilots who already have flown these instruments in Collins' Twin-Beech D-18 revealed for the most part strong approval of the general principle of combining attitude information with ILS steering information.

"You don't have to keep looking back and forth between the ILS indicator and a separate gyro horizon," one pilot explained. Another said, "The integration of attitude, localizer and glideslope information on a single indicator did not confuse me, but seemed logical, easy to follow and instilled confidence."

While mostly favorable comment was voiced on the picture presentation of the Course Line Indicator, the consensus seemed to be that a large picture instrument was desirable, but would have to be reduced in size to meet engineering requirements.

An interesting reaction of some airline pilots who have flown these instruments is that they would have no objection to complete replacement of standard horizon indicators by the Approach-Horizon, even though this information then would be combined with other indications.

Others believe it would be feasible to substitute directional gyro indicators now used with the Course Line Indicator with its full-scale gyrosyn compass repeater. In this case, Collins would be offering a system which adds not a single indicator to the lineup of basic flight instruments used now—by replacing some of these with its own multi-function models.

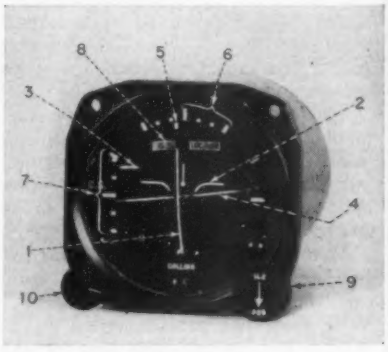
Both the radio firm and pilots holding this view agree, however, that replacement of such flight instruments is not presently in sight, requiring a long period of extensive testing and evaluation of the new instruments before CAA would permit it.

Leaving this possibility aside, the equipment is designed to remove the need for an ILS crosspointer indicator, omni bearing selector, radio magnetic indicator and compass repeater with heading selector, according to Collins.

▶**Other Systems**—The Course Line Indicator is not to be confused with Course Line Computers or Pictorial Computers with their associated distance measuring equipment (DME).

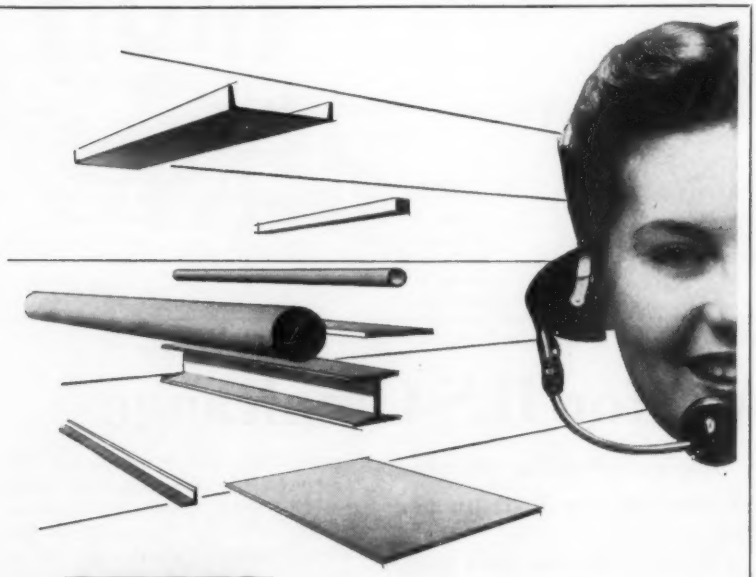
But cocking one eye on the future, Collins has designed the Course Line Indicator so it can be adapted to display information signalled by the Course Line Computer, now being developed by the same firm. In this case, the CLI would show position of an aircraft, not only with respect to a chosen localizer or omnirange course, (omni radials) but with respect to a selected course offset or parallel to omnirange bearings.

Operation of the instruments, as installed in the radio firm's Twin-Beech, was demonstrated to AVIATION WEEK reporters in flights from Westchester Airport and LaGuardia Field. While flying on information provided by this system, the presentation seemed to this reporter to be straightforward and clear.



▶**Approach-Horizon**—This indicator carries a vertical pointer (1), a pitch attitude indicator (2), a glideslope pointer (3), horizon bar (4), bank indicator (5), and graduations at the top and side of the indicator indicating bank (6), and pitch (7) respectively. The unit also includes on-off flags for glideslope (8) and localizer (photo above).

Rate information is fed into the vertical pointer (1) so that, by keeping the



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pointer centered, you automatically make an asymptotic approach to a localizer beam and stay on it. You do not depend on it for position information. For this, you refer to the Course Line Indicator. For you might be displaced to the left of your course, yet the needle could be centered, indicating you are steering the plane correctly to arrive smoothly back on course.

Deflection of the needle could mean you are displaced from the localizer beam, that you must correct to maintain a rated approach, or even that you are "on" the beam, but flying in a manner that won't keep you there. Your main interest in it is to keep it centered where it can mean only one of two things, that you are approaching the beam just right or are on the beam and flying it just right. The needle won't let you steer "just right" on a course parallel to the runway beam. It won't center. And it automatically corrects for drift by forcing the pilot to "crab" the plane to center it.

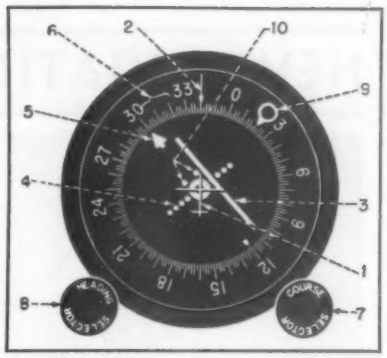
To guide you, the needle is fed heading, displacement, bank (roll) and drift information from the system's computer amplifier. Here is how Collins explains theory behind operation of the needle:

"A smooth exponential approach to a track such as the localizer may be made if the aircraft's speed, plus the rate component toward the track, are made proportional to the displacement from the track. This condition may be approximated by adding voltages proportional to the aircraft's bank angle (from a gyro horizon), heading differential (from a magnetic compass plus a selected angle), and lateral displacement (from radio receiver) and putting the sum on a meter. When the meter is made to read zero the aircraft is following an exponential curve onto the track."

► **Pitch Attitude**–This indication (2) moves vertically from top to bottom of the indicator to show nose up or down attitude. The horizon bar (4) is pivoted at the center and indicates roll or bank of the plane. It is independent of the pitch attitude.

The glideslope pointer (3) shows you how to steer on glideslope. It tells whether you are displaced above or below this track. You are flying properly on glideslope when the pointer (3) is aligned with the pitch attitude indicator (2). To stay on glideslope, you "follow" the glideslope pointer with the pitch attitude indicator. If it goes up, you go after it to keep pitch and glideslope aligned. This presentation is also true of the vertical needle; if it moves left, you follow it to the left.

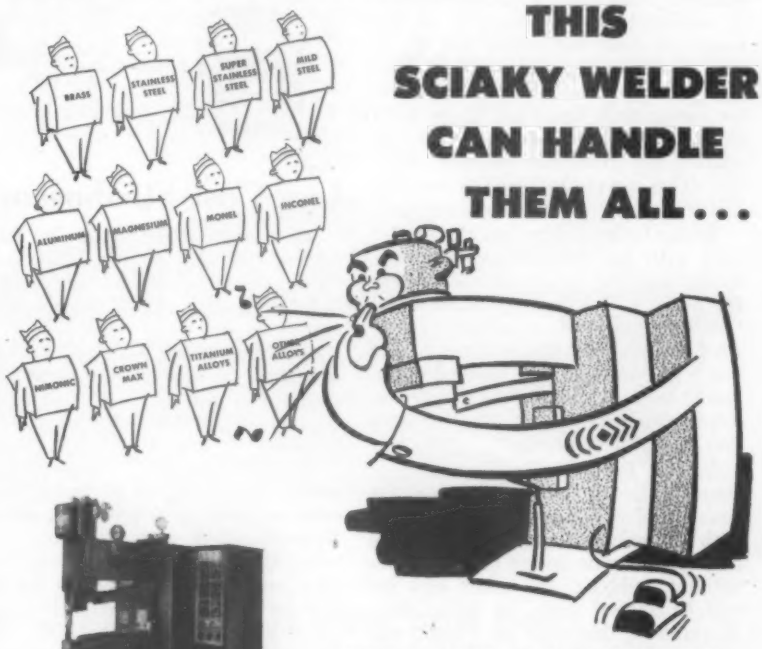
► **Switches**–The "ILS-HDG" knob (9) determines if vertical needle is to be used for approaching and staying on localizer or flying compass courses. The



pitch trim knob (10) simply bases pitch attitude indicator so pilot can fly fixed position attitudes (photo p. 44).

► **Course Line Indicator**–It might be said the Approach-Horizon gives you a vertical cross-sectional display, that is attitude, displacement with respect to glideslope (coupled with steering and rate information for selected courses on a horizontal plane), while the Course Line Indicator gives you a plan-view or flat presentation.

The CLI gives you an actual picture of the displacement and heading of your plane with respect to a chosen omnirange or localizer course. You don't have to interpret the presentation at any time. You simply picture the miniature plane (1) painted on the in-



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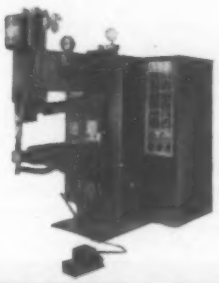

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strument glass as your own. The plane is fixed and centered, pointing straight ahead to the fixed lubber line (2) at top of instrument. (See sketch p. 47).

To indicate displacement with respect to a selected course, the course line bar (3) moves to and from the miniature plane, perpendicularly to the dotted line (4). To show how the plane is headed relative to a selected course, the bar is carried in rotation along with the dotted line. The white arrow (5) continually points on the compass repeater (6) to the omnirange or localizer bearing selected. It is operated by the "Course Selector" knob (7). Deviation in heading from a selected omnirange or localizer course is indicated by displacement of the arrow (5) from the lubber line (2) at the top of the indicator. The lubber line points to the magnetic heading you are momentarily flying on. If you want to fly a selected (compass) course, you operate the "Heading Selector" knob (8). This moves the "heading marker" (9) to the magnetic bearing desired.

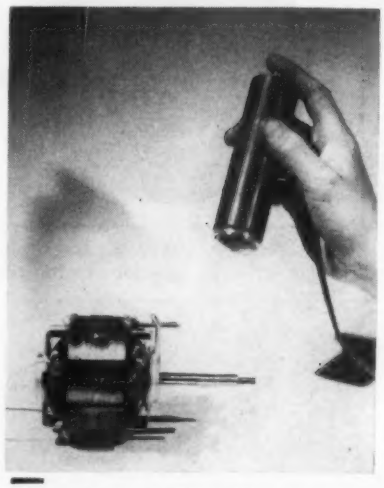
With change in heading, the marker rides with the compass azimuth ring, always pointing to its selected bearing (omni arrow does same). You are flying "on" the selected (compass) course when the marker aligns with the lubber line. Deviation from a selected (compass) course is indicated in degrees by displacement of the marker (9) from the lubberline (2).

You are flying "on" a selected omnirange or localizer course, when the course line bar centers and lines up with the omni selector arrow. If the plane is flying on course to destination without crabbing, the arrow and bar will be aligned with the lubber line. If crabbing, but still on course, the arrow and bar will remain together with plane, but will be displaced from the lubber line. To-From indication is provided by flags (10) which appear on the appropriate side of center.

Collins stresses that "when the miniature airplane is pointed toward the course line bar, the aircraft is approaching the selected course. This is true even in localizer service, regardless of whether flight is inbound or outbound on either the front or back course of the localizer."

American Airlines has expressed interest in Collins' new system and PanAm intends to flight test when the set is available. PanAm is showing increasing interest in omnirange equipment, not only for coastwise navigation in this country, but for use in Europe, where ground omniranges at London, Paris and Rome are in operation or planned and a network of around 20 stations is in various levels of planning and construction throughout the Continent, west of the Iron Curtain.

NEW AVIATION PRODUCTS



Low-Cost Stroboscope

A low-cost stroboscope is being marketed by Synchroscope Co.

The device is said by the company to be particularly suited for field service operations involving check-out of aircraft motors, generators, timing devices, and other components utilizing synchronous speeds. It also is ideal for production and laboratory testing, the firm believes.

The unit has a built-in flashlight, providing an instantaneous light source with no warm-up required. It uses an electronic cold cathode triode tube which rectifies the line source and gives off a pulse of light only during the positive portion of the ac. cycle. The visual pulse per cycle stroboscopically stops the motion of a synchronous motor or other device that is operating in synchronism with the line frequency. Address: 57 William St., New York 5.

Jet Blanket Repair

Repairs to insulating blankets that fit around jet engine tailpipes can be made in the field with the "Hit-Kit" portable resistance spot welder, made by H. I. Thompson Co.

The Hit-Kit welder was developed for on-the-job repair of Inconel and stainless steel foil and screen, primarily in Refrasil insulating blankets. Besides repair, it can be used to make alterations on these blankets dictated by a change in design, the company says. It explains, however, that versatility of the equipment is such that it also has wide use in other applications. The standard model includes tools and materials necessary for many types of repair. Foil thicknesses up to .004 in. and screen wire diameters up to .020 in. can be easily spot welded, says the firm.

Welding is accomplished by contacting both electrodes to the foil surface and inducing current by operating a trigger switch. The welder is equipped with leads 9 ft. in length attached to welding tips and operates on 110 v. ac. Power consumption is said to be low, permitting economical operation. The complete kit fits in a strong, sheet steel box with lift-out tray and carrying handle. Box measures 20x10x8 in., and with all equipment weighs 35 lb. The set is priced about $225. Address: 1733 Cordova St., Los Angeles 7.

ALSO ON THE MARKET

"Sound-Powered" intercom for industry or field use requires no batteries. Telephone derives all power to transmit speech from voice itself. System is said to provide "noteworthy" fidelity of speech and can be used to ring and talk at distances up to 20 miles. Made by the Wheeler Insulated Wire Co., Inc., division of the Sperry Corp., Waterbury 91, Conn.

Metal slitting machine for small shops with no room for large shears and bigger shops with too much work for their heavy shears also can be moved to construction site for on-the-job work. Will handle up to 16 or 20 gage mild steel and sheets of 4-ft. width up to any length. Made by Wilder Mfg. Co., Carmel Valley Route, Monterey, Calif.

Bronze bushings and bearings are available in variety of types which may be plain, flanged or split or any combination. In size, bearings range from parts no bigger than the end of your finger up to two ft. in diameter. You can buy them in any number from a single unit to a thousand or more, either machined-finished for precision applications or semi-finished for rough work. Made by Bronze Bearings, Inc., 738 North Ave., Cranford, N. J.

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With his Beechcraft Bonanza, Mr. Minier figures he does *seven* days' productive work in *five* days' time. And he has week ends free! That's two extra days per week. In terms of work done, his year "lasts" far longer.

Mr. Minier is Regional Manager of Gamble-Skogmo, Inc., distributors of auto and radio supplies, and hardware. His territory sprawls over six western states. "I travel thousands of miles monthly with no fatigue," he says. "That's as important to me as time saved."

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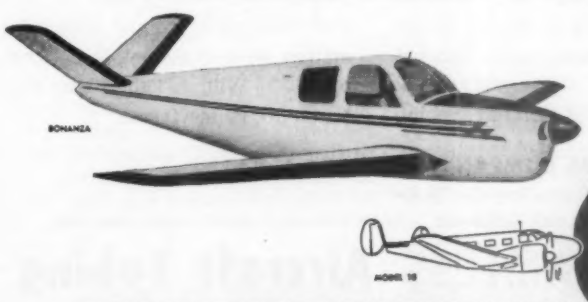
Get the *whole* Model C35 story from your Beechcraft distributor. Or write today to Beech Aircraft Corporation, Wichita, Kansas, U.S.A.



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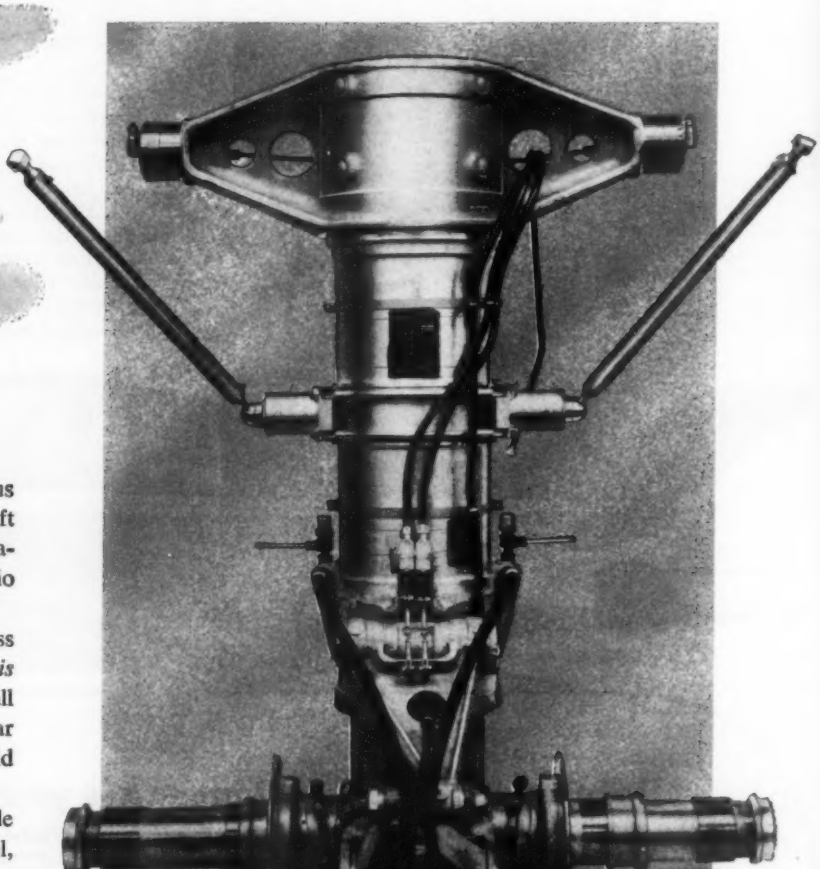

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OUT: Sigmund Janas.

Janas Quits as Colonial President

Management reorganization heads off CAB hearing on charges of bad accounting and misuse of firm's funds.

A new top management has taken over Colonial Airlines and will report regularly to the Civil Aeronautics Board on progress in a campaign to meet CAB's demands in accounting and operations.

Sigmund Janas, Sr., has resigned as president of Colonial and has signed an agreement to pay back $75,000 to the airline. And CAB has agreed to cancel public hearings scheduled for July 9 to investigate alleged mis-use of company funds.

A reliable source at CAB says this case will have a salutary effect on certain operations of some other airlines.

▶ **Charges**—Janas, Vice President A. M. Hudson, and Colonial have signed an agreement with the board which includes provision that Janas will file a plea of "no defense" to all counts set forth in a list of "criminal informations" filed by CAB with the U. S. District Attorney in New York.

These "informations" charge Janas "(1) with permitting or suffering persons to receive free or reduced rate air transportation and (2) 20 counts of failing, or causing Colonial to fail, to keep accounts, records and memoranda in the form and manner prescribed by the uniform system of accounts for air carriers."

▶ **New President**—Alfons Landa, Washington attorney and recently-elected Colonial director, is the new airline president. A three-man executive committee now is managing Colonial. It consists of: John Murphy, Robert Herrnstein, and Orville Cameron.

Cameron left CAB's Bureau of Economic Regulation only this winter to become Colonial vice president and secretary; Herrnstein is a new vice president and controller; Murphy has been an independent director of the company. New Colonial President Landa has handled a number of cases for Colonial in the past. He is a general rather than specialized attorney. He is known as an authority on company organization.

Janas remains as a director of the company and as a salaried assistant to the new president. In its bill of particulars against Janas and the company, CAB says the airline has been under "complete domination, control and direction of its president, Janas," since 1938. CAB sources say the Board feels Janas should assist the new president in the management transition period for the very reason that the airline has been a one-man company for 13 years, and hence needs the assistance of that one man at least for a while.

The new president and the three-man executive committee were elected by the Colonial directors in conformance with the "proposal of adjustment and consent" signed by Janas, Hudson and the airline, and accepted by CAB.

▶ **No Hearing, No Embarrassment**—It is a common procedure for a government agency to settle such management reforms without public hearing. Avoiding the formal and public hearings this way means less cost and less time waste to the government, and it means less embarrassment to the reforming company.

The Board approved the Janas offer to pay back $75,000 to Colonial because this will cut the mail pay need of Colonial, and hence the cost to the taxpayer. Janas has already paid the company $25,000 in cash and has delivered a note for the $50,000 balance—to be paid at $10,000 annually. The note is secured by pledge and mortgage of Janas' assets. He has also promised to pay the fines that may be imposed on Colonial, as well as himself, in the criminal actions that may be pending.

▶ **Reorganization Plan**—Main points of the proposal to CAB by Janas, Hudson and Colonial's directors:

• "**Janas will resign** as an officer of Colonial . . . .

• "**Colonial will appoint an Executive** Committee of three members consisting of:

"(A) One director, who is not an officer of the company.

"(B) The treasurer, the comptroller or such other officer of the company as may hold the position of chief accounting officer; and

"(C) The secretary of the company.

• "**The executive Committee** will be charged with the following functions, powers, duties and responsibilities in connection with the administration and operation of the company: . . . . Proper recording of all revenue and income. . . . Control and approve the disbursement of all funds. . . . Review all existing contracts, leases and other agreements. . . . Employment and dismissal of employees. . . . Assure that no funds are diverted or withdrawn from the company for any purpose other than the operations. . . . The Executive Committee will exercise and perform the functions, powers, duties and responsibilities set forth herein until further order of the board.

• "**Criminal informations** are to be filed by the appropriate United States Attorney charging Janas (1) with permitting or suffering persons to receive free or reduced rate air transportation; and (2) 20 counts of failing, or causing Colonial to fail, to keep accounts, records and memoranda in the form and manner prescribed by the uniform system of accounts for air carriers. Janas will file a plea of nolo contendere (no defense) to all of the counts set forth in such information. . . .

• "**The Board may recommend** to the . . . attorney, if it so desires, that the Court be requested to impose fines in amounts in the discretion of the Court on some of the counts and that

sentence be suspended on other counts in each type of violations upon condition that there will be no future violations for a period of five years.

• "**Janas will pay $75,000** to Colonial on or before June 15, 1951. . . . No part of any fine or fines imposed on either Janas or Colonial shall be reimbursed by Colonial to Janas in any manner. . . .

• "**Colonial, Janas and Hudson** hereby consent to the entry of a cease and desist order by the Board. . . ."

► **Violations**—Among the alleged law violations claimed by CAB in its bill of particulars against Janas, Hudson and the company are:

• **Speculation** with Colonial's funds in Canadian dollars for personal profit.

• **Using company money** for family expenses including jewelry, groceries and clothing.

• **Taking kickbacks** from Colonial employes and affiliated firms.

• **Not reporting** investments in other air carrier companies.

• **False bookkeeping.**

• **Giving free passes** to friends, and business associates.

CAB Rule Changes Asked in Part 302

The Civil Aeronautics Board proposes a whole new set of rules under Part 302 to streamline procedural regulations. More will come later. One important change in this first batch calls for an examiner's report on mail pay, if the airline wants it, before the board makes a decision.

Here are some of the changes proposed:

• **Documents.** Rule 4(B) eliminates verification; signature is enough for certification.

• **Counsel and attorney.** Rule 9 includes public counsel and an enforcement attorney under these rules.

• **Intervenor.** Rule 15 details the rules on who can intervene and how.

• **Examiner, hearings.** Rules 22, 23 and 24 detail powers of the CAB examiner, purpose and manner of prehearing conference, answers to some troublesome hearings procedure questions of the past.

• **Mail pay.** Rule 27 says the examiner shall make an initial decision in rate cases if any party asks him to. This means the initial decision is by an examiner instead of a tentative decision by the Board. This is supposed to speed things up for the Board.

This is followed by a single oral argument; before, oral argument went before the tentaive decision of the Board.

The CAB staff prepared these and many more rule changes proposed. The rule proposals are all in a 65-page report—Procedural Regulations; Draft Release No. 1; Revision of Rules of Practice in Economic Proceedings.

AMERICAN'S all-daylight Flight 58 helps to touch off great upturn in business.

AA Leads Soaring Mexican Traffic

Promotion efforts show results as American registers 5-percent gain and even domestic carriers thrive.

(McGraw-Hill World News)

By John Wilhelm

Mexico City—American Airlines, which has stepped up its promotional activities in this area noticeably during the last year, has found that its efforts are paying off.

Over its heavily traveled Mexico City-Dallas-New York run, American carried 71,327 passengers during the past year to place itself well out in front of all competition, insofar as international traffic is concerned. American does not handle local traffic.

This gave American a traffic gain of about 5 percent over the previous year. While the company did not make public its profit and loss statement on the Mexican operation, trade circles reported that American had broken into the black on this leg for the first time since it began flying this route.

► **The Whole Picture**—The whole Mexican aviation picture showed interesting gains during the past year with the biggest jump going to use of air express.

• **Compania Mexicana de Aviacion** shoved air express up some 60 percent, carrying some 11,000 tons over its network (the largest in Mexico). CMA is a Pan-American affiliate.

CMA placed three new DC-6s in service during the year (on routes to Los Angeles and Havana from Mexico City) and with this new equipment was able to up its passenger traffic 5.7 percent to total paid passages of 263,327. CMA reported a profit of over $500,000 in 1950.

• **LAMSA,** the United Air Lines affiliate in Mexico, also got in the air express picture with an 83 percent gain for a monthly tonnage of some 75 tons. Both CMA and LAMSA used lavish promotion to develop this new business. CMA stressed cheap rates and rapid pickup and delivery, while LAMSA sold "gourmet" club packages of fresh foods such as fresh crab and tropical fruits flown in from the diverse areas of Mexico.

LAMSA, in addition to the air express increase, also upped its passenger traffic 65 percent though it still did not get its operation in Mexico into the black.

Officials report, however, that the Mexican operation was profitable in the last few months of the year, and they expect at least to break even on the Mexican end this year.

The United Air Lines subsidiary planned to step up its frequency of flights on July 1 when it was add a nonstop flight to Torreon, then on to Ciudad Juarez, across the border from El Paso, Texas. Previous flights on this route were more or less local service.

LAMSA will also add a shuttle from Monterrey, in northern Mexico, to Torreon. There is now no air service between the two. A San Luis Potosi shuttle will have a second flight added.

• **Pan-American,** flying into Mexico City from Guatemala and northward to Houston (where it connects with Eastern), carried 31,128 international passengers during the year, but to this should be added the international traffic carried by its subsidiary CMA (Los Angeles and Havana), which gives it a total of 55,519 international passengers for both lines.

• **Aeronaves de Mexico,** the line making the heavily traveled one-hour run to the popular resort center of Acapulco

on the Pacific coast, placed DC-4s on the short flight and was able to haul 162,000 passengers during the year. This compared favorably with the 124,000 passengers carried by Aeronaves in the previous year when it was using nothing but DC-3s.

• **Aerovias Guest,** which bills itself as "Mexico's International Airline," although it is owned and directed by Winston Guest, an American, ran into trouble on its flights from Mexico City to Madrid during the past year and no longer flies this route. Trouble arose over exchange agreements with the Spanish government, with the result that Mexico canceled the reciprocal permission of the official Spanish airline, Iberia, and Spain canceled Guest's permit.

Aerovias Guest pulled its four DC-4s off the European run and placed them on a Mexico City-Miami service.

Guest had this Miami route ever since it secured CAB certification over a year ago. Linking up at Miami with National, Guest has been able during the last few months to advertise a daily service to Miami with one-stop connection to Washington and New York.

Despite heavy advertising of this one-stop advantage over competitors (American stops at San Antonio, Dallas and Washington before New York; Pan-American transfers passengers to Eastern at Houston with a stop at Washington before New York), trade circles report that Guest has found only a moderate market.

Guest has never claimed a profitable operation to date, and speculation exists as to how long the line can continue a losing business. However, financial backers have shown no sign of weakening.

► **New Airport Work**—A number of new airports have been, or are being, built in Mexico. Latest and newest is the $1.4-million Guadalajara airport in west central Mexico which is said to be the best airport in Mexico now. Its two main landing strips of 7,000 feet and 6,900 feet are said to be capable of handling DC-6s if and when CMA gets around to putting them on the Guadalajara run.

Work on runway extension in the Mexico City airport is about completed and is now more than adequate to needs of this increasingly busy field. Construction of the new Mexico City terminal building is underway, although it will be another year before it is finished. The new terminal is needed urgently as traffic has completely overwhelmed the old one which is now in use.

Delay Seen in Switch to Omni

Study by special group of Air Coordinating Committee reports that VOR equipment is lacking for planes.

The Civil Aeronautics Administration installation program budgeted for VOR omnirange communications and navigation cannot fully replace the existing low-medium frequency four-course range system. About 78 of the old L/MR radio ranges will have to go on operating for many years at full 400 watt power. And CAA can't start decommissioning the other 260 L/MR ranges at least until fiscal 1953, except for a few unimportant facilities.

These are the findings of the Air Coordinating Committee's special working group number six. The group has just finished a comprehensive policy paper on equipment needed to handle U. S. air traffic and air defense.

► **Equipment Lacking**—Chief reason the CAA cannot make the switch-over to VOR omnirange soon is that the great majority of both military and civil planes are not VOR-equipped—and won't be for many years to come. As programmed now, the Navy and Air Force planes will not be completely equipped for HF until 1958.

And under the CAA omnirange program currently planned, Air Defense Command couldn't even contact all VOR-equipped planes in an alert, let alone reach the planes with no VOR receivers.

ACC is now working out a definite policy and priority system to decide when and how the ultimate switch-over from low to high frequency traffic control, communications and navigation system should occur.

The ACC working group stresses that the lack of a definite timetable has caused both the military and civil users to drag their feet on buying VOR receivers. And that causes the "thin" market for airborne VORs, thus slowing even further the date of availability of a suitable low-cost, light-weight airborne receiver.

Says the group: "The lack of a positive plan for the decommissioning of L/MF radio ranges only tends to curb the potential market for this omni-receiver equipment and its further development, creating the situation of 'which comes first, the chicken or the egg?'"

The ACC group summarizes the situation: "Because of the national de-

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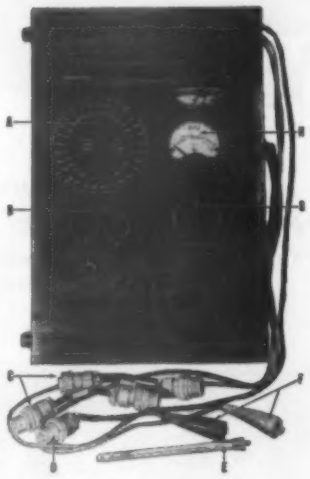

A Temperature selector switch
B Resistance-voltage selector switch
C Adaptors for connecting single ratiometers
D Resistance thermometer plug lead
E Liquid-in-glass thermometer
F Thermocouple thermometer clip leads
G Rheostat. H Standardizing voltmeter

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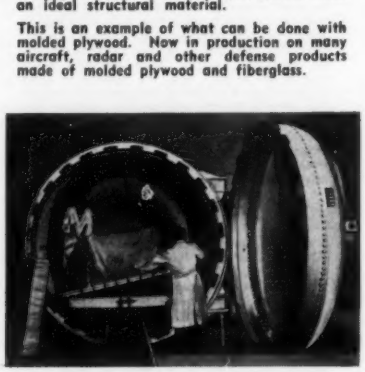

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fense the CAA program to decommission the four-course L/MF ranges must be deferred until the majority of the using aircraft are ready to convert and use the VOR as a primary aid." Total decommissioning cannot be permitted until some substitute is developed to take care of certain communications and navigation functions that VOR can't do —unless the VOR ground installation program of CAA is greatly expanded, the Air Coordinating Committee group says.

► **Switch-Over Timetable**—The few low-frequency CAA ground stations that are unessential for national defense or air traffic control will be decommissioned in fiscal 1952.

A minimum national defense system using 78 stations will remain in operation indefinitely. And those 78 stations should be stepped up to full power of 400 watts. This system will be a "limited national system," with ranges located so that they will take care of the most important navigation routes and at the same time serve as a radio network to alert and recall all planes in case of military emergency.

The majority of the existing 338 ranges will be decommissioned long before these last 78, but certainly not before 1953-4.

The main switch-over period will be two years. Some 30 percent will go out the first year, the rest the second year.

By Feb. 1 next year at the latest, the ACC Navigation Panel will make the decommissioning schedule definite, so that CAA can prepare its fiscal 1953 budget.

► **Equipment Programs**—Here are current figures on useage and installations programs of the old L/MF four-course radio ranges and the new VOR omniranges:

• **About 300 omniranges** are in commission now; there will be 419 by June 30, 1952, 444 by June 30, 1953, and 500 by June 30, 1954. Present CAA estimates are that 500 will be enough, including both enroute and terminal facilities. This will afford approach facilities for about 455 civil airports.

• **52 percent of the scheduled airline fleet** have at least one VOR receiver. By Jan. 1, 1952, that figure will be 89 percent, for the present fleet—and perhaps 95 percent including both new and old planes. All new airliners are being equipped with dual receivers (duplicate set). By 1953, the airline fleet will be 100-percent-equipped with at least one VOR receiver.

But even by 1953 only 75 percent of the airline fleet is definitely scheduled to have dual VOR receivers. And safety and navigation efficiency demand a dual system in each plane if VOR is the sole control system. This estimate assumes that about 1,100 receivers now on order will be delivered on schedule.

As to non-airline civil aircraft, CAA figures production of VOR receivers will be 5,100 units the last three quarters of this year. There were 4,500 units in service the end of the first quarter. That means there should be 9,600 VOR receivers in non-airline planes by the end of this year. About 61,000 civil non-airline planes are operating today. Of these, 20,000 have two-way radios, 18,000 have receivers only.

The great majority of military planes do not have VOR receivers.

► **Can't Be Done**—Here is why the ACC group finds the CAA omnirange program insufficient to replace fully the old low-frequency system.

• **Communications:** 1. Since omnirange is limited to line-of-sight contact, it will not satisfy the communications requirements of operators of small airports in many areas that do not have drops on meteorological teletype circuits.

2. Because of this line-of-sight limitation, Air Defense Command could not reach planes flying low, or outside the service area of any omnirange, during a period of military emergency. Says the ACC group: "It is essential that the CAA retain the ability to transmit recall and other instructions . . . to meet national defense requirements."

3. In a military emergency, CAA must be able to notify all planes and airport operators as to the conditions of the alert. The VHF omnirange communications channel does not meet this requirement.

• **Navigation:** 1. The CAA must keep up a limited L/MF airways system for a variety of purposes, such as cross-country VFR and IFR operations, Forestry Service, and in areas where generally VOR reception at low levels would not be available.

2. The VHF system may not take care of future high-speed jet operations for a few years. "It is expected, however, that the VHF system eventually will meet normal high altitude domestic navigation and communications requirements."

First Flying Boat Route Being Reopened

The world's first flying boat route is being re-activated.

Thirty years ago, six-seater, wooden Supermarine Sea Eagles plied the few miles from Southhampton, England, to the Channel Islands. The 46-ft. wingspan, open-cockpit biplanes had a top speed of 93 mph.

Early in July Aquila Airways is reopening a week-end service between Southampton and Jersey Island with Short Hythe boats. These four-engined civilian versions of the Sunderland will carry 27 passengers in a luxurious lounge.

Mid-Continent Buys 6 Convair-Liners

Mid-Continent Airlines has signed final papers to buy six new 44-passenger Convair-Liner 340s and spare parts at total cost of about $4 million. Cost of the planes alone is $3,265,000 or $544,167 each.

The Mid-Continent order specifies delivery of the first plane in March of 1953 and one each month thereafter through August.

Contracts were recently signed by MCA President J. W. Miller, left in photo, Convair's Vice-President-Contracts, J. B. Naish. Standing is R. J. Pfeiffer, Convair regional sales manager.

Mid-Continent already operates three of the 40-passenger Convair 240s, plus 23 Douglas DC-3s.

The carrier recently announced new financing to cover proposed capital expenditures of about $4,730,000 through 1953. This covers buying the six Convairs and construction of a new hangar and maintenance facilities at Minneapolis/St. Paul, and modernizing the DC-3 fleet.

Consolidated now has orders for about 100 of the new Convair-Liner 340s.

These are longer than the old Model 240, and have more wing area and almost double the fuel capacity of the older model of the same plane.

Salaries, Holdings of Locals' Executives

Salaries, bonuses and stock holdings in 1950 have been reported by four U. S. local service airlines.

▶ **Central Airlines, Inc.** President, Keith Kahle, salary $9,775, and stock holding of 3,435 common shares (1949: salary $4,250 and 343 common shares); vice president, R. E. Harding, Jr., $8,050, and 2,500 common shares ($3,500 and 250 shares); vice president and secretary, Donald B. Ehrhart, $6,900 and 2,500 common shares ($3,000 and 250 shares); treasurer, Marshall Gibbons, $4,600 and no stock (no 1949 report);

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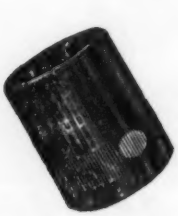

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and the following directors: F. Kirk Johnson, salary $1,950 and 7,500 common shares (no salary, 750 shares); James M. Stewart 1,000 common and 250 preferred shares (no 1949 report); John M. Hollern, 1,000 common and 250 preferred shares.

▶ **Empire Airlines, Inc.** President, Joe Lux, no salary and 708 common shares (1949: 708 common and 47,459 preferred shares); vice president, T. E. Robinson, salary $4,800 and 300 common shares ($4,800 and 300 common); secretary-treasurer, Arvid R. Nelson, $3,600 and 10 common ($3,600, 10 common and 670 preferred).

▶ **Los Angeles Airways, Inc.** President and director, C. M. Belinn, salary $15,000 and 8,675 common shares (1949: salary, $15,000 and 8,425 common shares); secretary and director, M. J. Burke, no salary and 3,750 common shares (no salary and 3,750 shares); treasurer and director, Wayne H. Fisher, no salary and 2,550 common shares (no salary and 2,550 common shares); and the following directors: James G. Lombardi no salary, no stock, and Emerson B. Morgan, 1,000 common shares (1,030 shares).

NAL DC-6 Day Coach N. Y.-Miami Asked

CAB Examiner R. Vernon Radcliffe recommends that CAB let National Airlines operate a daylight DC-6 air coach New York-Miami.

Proposed one-way fare is $58, compared with night coach fare of $53, regular fare of $76, and off-season 16-day excursion fare at a net one-way cost of $57.

Eastern Air Lines opposes the service. But Eastern says it will start competitive daylight coach service in Constellations if CAB approves the National application.

Chief reasons Radcliffe gives for approving the DC-6 daylight air coach are:

• **New market** tapped by the low-fare service would more than make up for the diversion from other services.

• **No discrimination** or other legal problems are posed.

Examiner finds that on the Los Angeles-San Francisco run, 65 percent of the UAL and Western Airlines service is coach. New York-Miami could work out well at that, instead of present 53 percent coach, all at night.

The CAB skycoach survey of April-May, 1949, and the Census Bureau survey of nonsked traffic showed that 30 percent of coach passengers may be first flighters—a sizeable chunk of new business.

And Radcliffe estimates the coach will pay even if only 10 percent of the daylight coach service of National and Eastern were new business and all the rest were diversion from their night coach and regular fare service. He estimates that diversion will be on the order of three passengers from the night coach for every three from regular fare service.

And up to 30 percent will be new business taken from surface transport and nonsked air carriers.

Fully allocated cost per available seat mile in the proposed daylight coach

would be 2.257 cents. At 5.2513 cents a mile in revenue, break-even load factor is 43 percent on passengers—40 percent including cargo. National estimated its load factor will be 79 percent. Annual net profit before mail pay and taxes would then come to $1,090,865.

Examiner finds the service will actually net the company somewhere between $1,071,905 and $687,136. The latter figure is what NAL would net if all the daylight coach passengers were merely diverted from other services (assuming: the daylight coach is substituted for a regular-fare flight; and no allowance is made for possible elimination of a flight because of the greater coach seating capacity.)

The daylight coach would seat 68 passengers, against regular-fare 58-passenger capacity.

SHORTLINES

► **British European Airways**—The board chairman Lord Douglas of Kirtleside says in a special message to his staff, quote: "We have beaten the million. When the actual figures of BEA's 1950/51 accounts are eventually published, they will show that the corporation has reduced its deficit from the previous year's 1,360,000 pounds to approximately 980,000 pounds." Lord Douglas says he had hoped for an even lower deficit, but increased fuel duty and devaluation upped costs by some 700,000 pounds. . . . BEA says it achieved its revenue target of 9,000,000 pounds in spite of poor winter traffic.

► **California Eastern Airways**—Robert E. Caskey, Cal Eastern vice president West Coast operations, has been elected a company director. Former Operations Manager Fred W. Caton is named vice president operations at Oakland and Neil Berboth is named vice president planning and research in addition to present duties as secretary.

► **International Civil Aviation Organization**—ICAO budget adopted by the U. N. Assembly for calendar 1952 is $2,834,191 (Canadian) compared with 1951 budget of $2,812,000.

► **Miami International Airport**—Over 44 percent of all foreign air travel to and from the U. S. the first two months of this year has moved through Miami International, according to the U. S. Immigration and Naturalization Service. Miami handled 96,921 International travelers. New York is second with 56,653 and New Orleans third with 8,089.

► **National Airlines**—National reports

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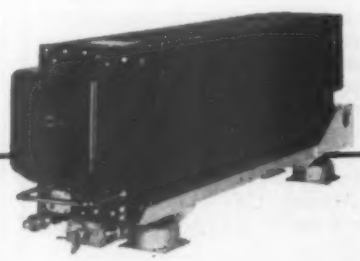

net profit of $112,539 in May. That's 11 cents a share, compared with a 2-cent loss the year before. Income taxes took $99,799 and depreciation $12,353. . . . This brings National's eleven-month net profit to $2,533,697 or $2.53 a share against $479,759 or 48 cents for eleven months last year. . . . May has generally been a low month for National—between winter season's end and summer travel's start.

► **Northwest Airlines**—NWA Boeing Stratocruisers have been averaging 85 percent load factor, with carrier's entire four-engine fleet running 81 percent loads compared with 69 percent last year, says President Croil Hunter. NWA had passenger revenues of $123,206 on June 19, the biggest single day total in its history. Operating revenues ($51,396,511) increased 25.6 percent in 1950 over 1949 and passenger revenues last year ($33,148,395) were up 18.9 percent. NWA increased freight and express revenues ($4,122,222) by 30.3 percent and carried a new high of 854,459 passengers in 1950.

► **Philadelphia International Airport**—Local coroner report on the NAL DC-4 crash Jan. 14 at Philadelphia claims three parties were culpable: airport management for not finishing runway repairs as fast as possible; pilots for apparently insufficient attention to runway condition reports and also for misjudging distance to end of runway; and NAL for not having reversible propellers and more safety doors in the DC-4 aircraft.

► **Philippine Air Lines**—PAL has opened new offices in Paris and Zurich.

► **Sabena**—Belgian airline's helicopter mail service to eight Belgian cities has hauled 63,842 pounds of mail the first nine months of operation.

► **Slick Airways**—Slick has started triweekly, over-night air freight service between Los Angeles and Dallas-San Antonio. This is the only all-air-freight service on that route, Slick says.

► **Spain**—Spain has been elected to fill a vacancy in the 21-nation council of the International Civil Aviation Organization (ICAO). Spain was the only candidate. Term of office will continue until 1953, when a new council will be elected. . . . Aviacion Y Comercio, S.A., Spanish airline serving Spain and the west coast of Africa, has become an active member of the International Air Transport Assn. The IATA membership now includes 65 companies, carrying 90 percent of all scheduled international traffic. . . . Another long-haul Spanish airline is Compania Mercantil Anonima De Lineas Aereas Iberia. It has been an IATA member since 1945.

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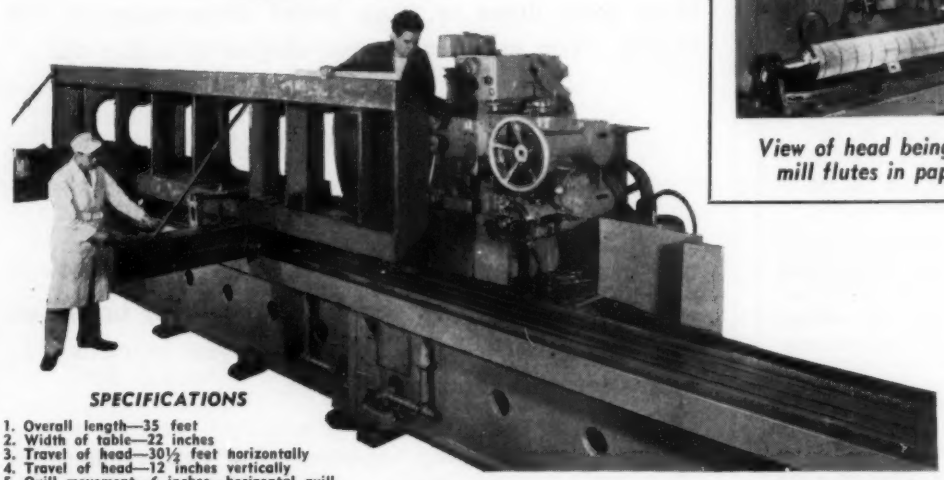

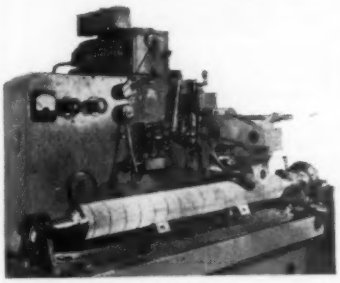

View of head being used to mill flutes in paper roll.

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1. Overall length—35 feet
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130	8288	Follower Assy
27953	8427	Screw
1276	10759	Bolt
980	11210	Cover
100	11762J	Guide
1157	35787-5	Bushing
2174	35787-10	Bushing
814	35814	Blower Assy.
3967	35817	Spring
280	35855	Cap
2446	35924	Washers
4200	35932	Gasket
22	36759	Rod Assy.
182	46400E	Liner
30	48346	Cylinder
1475	48360	Bearing
53	48362	Shaft
175	48363	Shaft
100	48389	Fitting
209	48390	Retainer
56	48392	Sump
533	48447	Bushing
107	48457	Adapter
390	48461	Gear
149	48468	Bearing
90	48468B	Bearing
389	48469	Bearing
470	48470	Bearing
75000	51506	Plug
395	54847	Clamp
71	57006	Cover
78	76236	Gear
565	81397	Tube
10736	84185	Cover Assy.
261	84235	Pipe
155	84281	Spacers
1351	84282	Adapter
1178	84289	Bearing
113	84487	Housing
87	84567-8	Stud
77	84591C	Nose Housing
178	84602	Bracket
30	84702	Shroud
397	84752	Bearing

ELECTRONIC COMPONENTS

Quantity	Part No.	Description
35	RA-10-DB	Receiver
20	TA12B	Transmitter
150	DA-1F	Dynamotor
35	MR-9B	Control Box
9000	45	Bulb
11000	1667	Bulb
1000	987	Bulb
300	AN3135-1	Bulb
97	FT213A	Mount
29	FT293	Mount
80	BX49-7	Dynamotor
6	RTA-1B	Transceiver

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19	M870036B Cylinder CO^2 Wt. Empty 5.48 lbs. Wt. of Charge 3.62 lbs.
22	982512 Cylinder CO^2 w/valve Wt. Empty 11.65 lbs. Wt. of Charge 7.25 lbs. Valve number 979453 J
96	992255 Cylinder CO^2 (type 5A-hand fire extinguisher) Full wt. 14.3 lbs.
93	982748 Oxygen cylinder (full) w/valve #X4015 Charges to 1800 PSI
150	982056 Valve 1-1/2" flare tube threads
150	966129 Solenoid (28 Volts)
225	981591 Gate Valve With 3 1-1/2" Flare tube threads
151	870082 (Model A4614) pressure switch Manually or pressure operated
326	982585 Gate Valve with 1-1/4" Flare tube threads

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1000	AN 5780-2	Wheel and flap position Indicator G. E.—individual cans
400	AN 5780-2	Weston Model 982-P N111602 Description as above
1500	AW 2-65B	U. S. Gauge Air Pressure Gauge (0-2000 lb.)
160	2E-402E	Pesco fuel pumps
700	TFD 8600	Thompson fuel booster pump
125	D-7818	Adel anti-icer pumps
170	2-P-771-A	Pesco fuel pump AN4102-1
250	AN4014	Erie Meter Systems D-3 hand wobble pump
300	1H2606 and KA	Pesco Hydraulic hand pump
478	D9530	Adel selector valve
233	D9530-2	Adel selector valve
428	D9560-2	Adel selector valve
744	D10044	Adel selector valve
2200	AN 4078-1	37D6219 Solenoid United Aircraft etc.
2000	AN 3096-4	Grimes Light assembly
800	AN 3096-5	Grimes Light assembly
389	AN 3095-6	Grimes Light assembly
175	EE 709-M2	Air associates Motor
115	F4CA2A	Parker Prisms
80	AN 3213-1	Scintilla Ignition switch
568	A-9 (94-32226)	Ignition switch
687	RS-2	Mallory Selector boxes
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88	572-3A	Eclipse Distributor Valve
90	JH-950R	Jack & Heintz Starter Motor for JH3 starter
492	S841 (94-32253)	Electric box
12	FA122	Flasher Exterior lights Wallace & Thomas
1000	13018A	Interphone Box
244	D10051	Selector Valve (Adel)
135	10996A	Instrument Panel for Republic Seabee
144	K14949E	Windshield Wiper Kit (Marquette Metal Products)
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195	350AJ	Lear Screw Jack
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COCKPIT VIEWPOINT

Toward Automatic Message Transmission

Without adequate communications, our modern airplanes would become economic impossibilities. Until a means of automatic air to ground message transmission arrives, the already overloaded demands must be met with existing VHF (Very High Frequency) voice facilities.

VHF is almost entirely free from "natural" interference. This increases the potential service over the low frequency band. But this "line-of-sight, static-free" feature in turn increases interruptions from other transmitters on the same frequency. The rapid growth of VHF-equipped towers and the specialization of functions within towers long ago ate up all allocated frequencies. So it was necessary to repeat frequencies at reduced spacings. Obviously interference resulted.

As this interference increased it became evident that a new allocation, or grid, plan was needed to rejuvenate the system. For this job RTCA established Special Committee 56. On Mar. 26 this group issued a report which is now being implemented by all parties.

This report of SC-56 will ease the communications problem. But it is also a technical report. So those who must read it will. Those who don't have to will never see it. Some immediate results will be:

- **Grumblings from the maintenance people** who must replace that crystal they put in last week;
- **Harsh words from the pilot** who cannot raise the tower on its habitual spot on the dial;
- **A flood of Notices to Airmen** on frequency changes.

Many will question the necessity for the changes and, seeing only bits and pieces of the plan, be inclined to doubt the existence of any plan.

▶**The Reason For It All**—Here was the situation seen by SC-56. Seven air traffic control functions require separate frequencies for direct pilot-controller communications. These are: 1. In-bound air route traffic control (more familiarly ATC), 2. Approach control, 3. Local control, 4. Ground control, 5. IFR departure control, 6. Outbound ATC, 7. Radar control (a) from the Center; (b) from the tower. In addition, emergency and international frequencies must be provided.

The area within a 200 mile radius from New York City was selected for detailed study of the problem. The demand in this area exceeds any similar portion of the United States at present, but not by much. By 1953 there will be 43 control towers and two Centers operating in this area. Obviously this means many airplanes requiring extensive communications in a relatively small space.

By lumping 18 low volume airports on a single frequency, by reducing the "clear channel" spacing to 125 miles and by making use of the voice facilities of ILS and VOR, total requirement for the area came to 30 separate frequencies. A study of Chicago showed that 22 frequencies were needed there, Los Angeles needed 28 and Cleveland 29.

Determination of these numbers entailed many things. A "nose" count of airports was simple. Arriving at the needed frequencies for each was more difficult. For this "work load" estimate the present CAA method of determining airport traffic control points was used. The specific jobs of each of the seven functions were also important.

For instance, how far out and at what maximum altitude does a plane normally require communications with the tower? With ATC? With Approach Control or GCA? This information, plus height of ground station antenna and several other factors yielded the minimum spacing between stations on any given frequency. Gradually, and with some compromises, a plan was worked out.

When the plan is fully implemented much will have been accomplished. Already the airline pilot over New York can get his approach clearance without being interrupted by taxi instructions to a plane at Hartford, the private pilot has suitable communications with "grass-roots" airports and military frequencies are less cluttered.

Automatic message transmission, probably utilizing the UHF band, should appear by 1953. This may, at last, allow one of the basic principles of air transportation to be fulfilled: Communications must keep ahead of the airplane. Until this happy condition arrives the grid plan of SC-56 will be an important tool for aviation.

—R. C. Robson

WHAT'S NEW

Miracle at Kitty Hawk (The Letters of Wilbur and Orville Wright), edited by Fred C. Kelly, published by Farrar Straus and Young Inc., New York, $6.00.

A classic "bawling out" from Wilbur Wright to Orville Wright, about the way their precious airplane had been packed for shipment to France, and its poor condition on arrival, was probably the first complaint about a shipment of airplane parts in the history of the aviation industry.

These and the nearly 600 other letters by the Wrights gathered in book form, will strike many a responsive note among today's aviation people.

They will find that Fred C. Kelly, the editor, has done a painstakingly thorough job of combing through some 10,000 letters by the co-inventors of the airplane, in order to make a chronological story of the brothers' work.

As a result the letters tell the Wrights' story, from their own viewpoint, far more completely than it has been told before, even in Mr. Kelly's own authorized biography of the Wright Brothers (Harper & Bros., 1943).

Of particular significance to historians are long letters detailing the views of both Orville and Wilbur Wright as to the respective contributions of other aviation pioneers who were contemporaries.

Among these are two Wilbur Wright letters to Octave Chanute in 1910 and a 1946 Orville Wright letter to this writer. Orville Wright's letter formed the basis of an exclusive article in AVIATION WEEK's predecessor magazine, AVIATION NEWS Mar. 11, 1946.

Probably the best picture of how the two brothers worked together is seen in the series of letters between them in the 1907-1909 period. Besides the classic complaint previously referred to, which resulted from a condition Orville always blamed on the French customs inspectors, other letters are full of exchanges of technical information about their flights, accidents, their causes; admonitions to each other about how they should fly, and genuine admiration and pride in the accomplishments of each other.

A few restrained editorial notes clarify background of some of the letters, but the letters themselves tell their own story.

The collection makes a worthwhile investment in reading time for anyone who is interested in aviation's beginnings.

—A.McS.

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NEWS Edo NOTES

EDO-EQUIPPED SEAPLANES INCREASE TUNA CATCH

Record hauls of tuna fish, and voyages cut in half, have resulted from the use of seaplanes equipped with Edo floats on tuna trawlers operating out of San Diego. Taking off and landing out in the Pacific Ocean, these light ships spot schools of bait in minutes, where days sometimes were wasted before.

Edo-equipped seaplanes are now standard equipment on 42 tuna trawlers operating out of California ports. Often the savings on one voyage alone more than repay the entire cost of the plane. With floatplanes more and more in demand for important industrial flying such as aiding the tuna industry, we at Edo are making every effort to maintain commercial float production despite material shortages and pressure of important defense work.

Fins and rudders for the F-84, radar nacelles, SA-16 wing-tip floats are among aircraft components being manufactured in quantity at Edo where we've had over a quarter of a century of aluminum design and fabrication. To this is added large sonar development and manufacturing activity by the Edo Electronics Division, now recognized as a leader in development of underwater detection equipment.

Edo CORPORATION
COLLEGE POINT, NEW YORK

EDITORIAL

Tribute to Atomic Pioneers

The pioneering first phase of a program looking toward nuclear powered aircraft was completed recently with little more than routine announcements. Because of the security veil, it was difficult for outsiders to assay progress made by Fairchild Engine & Airplane Corp. and the nine subcontractors to Fairchild's NEPA Division.

Recently, however, Hoyt S. Vandenberg, Chief of Staff of the Air Force, has written a commendatory letter to Richard S. Boutelle, president of Fairchild, which praises the company "for its unusual foresight in inaugurating the program of initial study of nuclear powered flight, for its significant accomplishments in pioneering research in this unique and difficult undertaking, and for the cooperative spirit and successful direction displayed throughout NEPA's existence."

Gen. Vandenberg notes that these accomplishments "are all the more noteworthy because they were achieved for our national defense under a no-profit type of contract."

The Air Force and Atomic Energy Commission announced completion of first phase contracts as of Apr. 30, and the opening of the development phase under a contract with General Electric Co.

Official Air Force announcements on NEPA (nuclear energy propulsion for aircraft) were sparse throughout its lifetime, but Gen. Vandenberg's letter reviews the origin, purpose and accomplishments of the project.

"The successful development of the atomic bomb made it apparent that a new source of energy had been discovered, which, if it could be used in the propulsion of aircraft, might make possible aircraft performance unattainable with any other fuel," the general writes. "The Army Air Forces was convinced that the subject was worthy of study, and it considered several industrial proposals for an investigation of the problem. The plan that Fairchild conceived and presented to the Air Forces was selected."

It was on May 28, 1946, that the AAF and Fairchild signed a letter of intent that created the NEPA project at Oak Ridge, Tenn. The project continued there for about five years in laboratories provided by the AEC and USAF.

The major goals of the project are described by Gen. Vandenberg:

(A) A careful and methodical prosecution of feasibility investigations and research leading toward the adaptation of nuclear energy as a means of propulsion applicable to aeronautical purposes.

(B) The introduction of considered aeronautical requirements into over-all nuclear research plans.

(C) The indoctrination and education of the recognized aircraft industry in the field of nuclear science and its adaptation to aeronautical propulsion leading to the time when the industry could undertake on its own behalf development of nuclear energy power plants for aircraft.

"In order to achieve these goals," the letter goes on, "your NEPA Division assembled a competent management and research and engineering staff. Also, through subcontracts, it utilized the capabilities of a number of universities, research institutes and prominent nuclear consultants. The indoctrination and education of the aircraft industry in this new field was accomplished through the 'member company' subcontracts with the following companies:

Allison division, General Motors Corp.
Continental Aviation & Engineering Corp.
Fredric Flader, Inc.
General Electric Co.
Lycoming division, Avco Mfg. Corp.
Northrop Aircraft, Inc.
United Aircraft Corp.
Westinghouse Electric Corp.
Wright Aeronautical Corp.

"Through the earlier years of the project, there was considerable official and scientific skepticism that NEPA's efforts could meet with any success. During this difficult period, officials of your corporation were exceptionally active and effective in supporting the concepts and manner of performance of NEPA. Without such active corporate support, the project might not have survived.

"The Lexington Report, prepared under the auspices of the Atomic Energy Commission, was especially effective in raising the technical optimism in this field. Its influence was to a large degree responsible for the formation of the Aircraft Nuclear Propulsion Program. Not until this time did the Atomic Energy Commission to any considerable extent bring its technical resources to bear on the aircraft reactor and shielding problems. The significant point is that the Lexington Report leaned heavily on NEPA's work, and it was in large part a summary and favorable evaluation of NEPA's technical achievements."

The letter reports that in the summer of 1950 the AEC formed the Technical Advisory Board, to review and summarize progress in the program.

"This group also relied on NEPA for much of its technical data. The general conclusion of TAB was that active development is warranted on the basis of what had been accomplished in the feasibility investigation.

"In entering the development phase, the conclusion was evident that the NEPA Project had successfully achieved its goals. NEPA was primarily responsible for establishing the view that nuclear propulsion for aircraft appears feasible. The companies who will carry the major burdens of the next phase received much of their indoctrination and education in this field as member companies and subcontractors of NEPA."

Gen. Vandenberg closes his letter to Mr. Boutelle with the words, "You can be proud in the knowledge that you have pioneered what may become a new era in the aeronautical sciences."

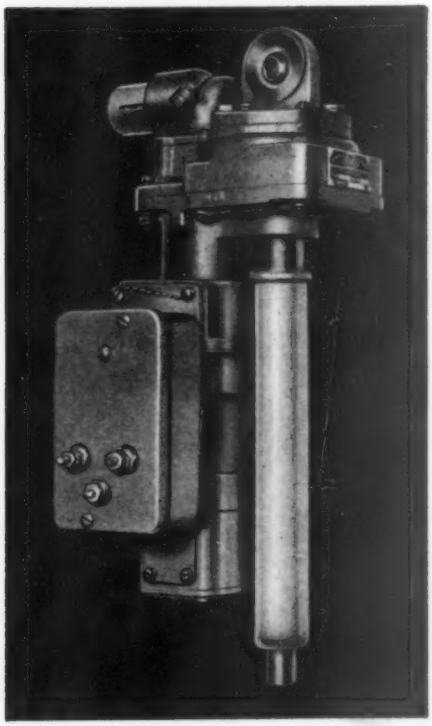
—Robert H. Wood

EEMCO technical bulletin

Featherweight Linear Actuator for Jet Wing Flaps

Typical of EEMCO's forward-looking designs is a new linear actuator for jet aircraft wing flap systems developed in close cooperation with a leading air frame manufacturer.

Two actuators are interconnected by flex shafting. A single brake operated by either motor provides quick and accurate positioning for system—maintains it under all conditions of load and vibration. In case of emergency either actuator can safely operate the entire system under any condition of ambient temperature and under maximum load with a supply voltage as low as 20 volts. Entire assembly weighs only 8 pounds, 3 ounces.



Actuator Screw Jack Data

Normal load 3000 lbs., 4 inches per sec. at 26 volts
Ultimate static load—ten thousand pounds compression in a fully extended position
Working stroke—5.14 inches
Non-jamming end stops
Provision for power takeoff or hand drive (right angle)
Radio noise filter for AN-M-40
Explosion proof construction
Weight—8 lbs., 3 ounces

Planes fly faster, range farther. Today's impossible is practical tomorrow. EEMCO design and production contribute to building electrical actuators thought impossible just yesterday.

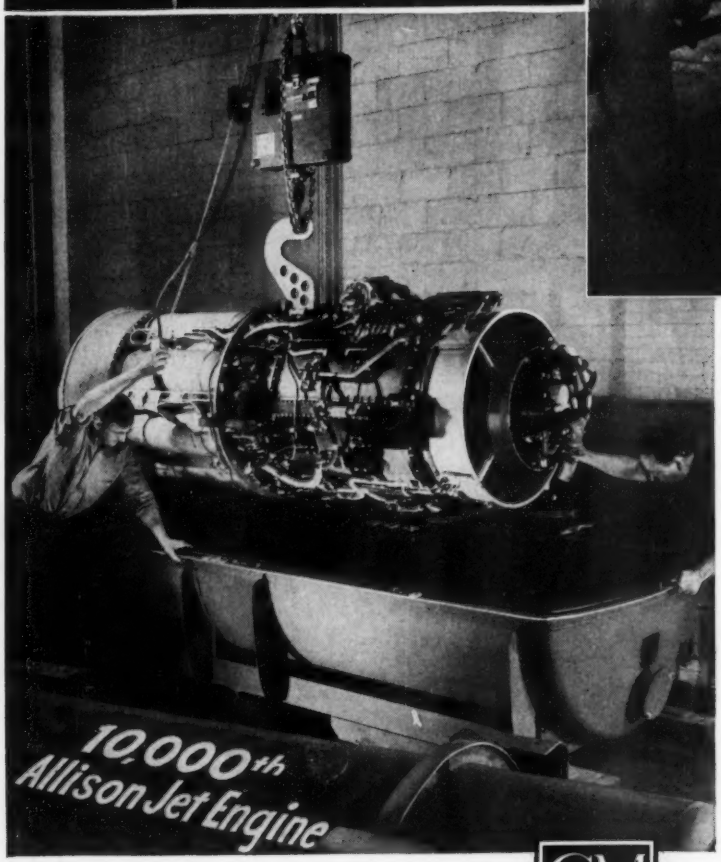
EEMCO

Helps You Build for the Future

ELECTRICAL ENGINEERING & MANUFACTURING CORP.

4612 WEST JEFFERSON BOULEVARD • LOS ANGELES 16, CALIFORNIA

Allison delivers its 10,000th Jet Engine



JUST six years to the month after start of production, Allison delivered its 10,000th jet engine to the U.S. Air Force.

Built largely during a period of peacetime activity, these 10,000 engines plot a curve of increasing power and dependability. *Thrust* was stepped up more than 50 per cent per pound of weight; *service life* was extended more than 300 per cent and important improvements were made in *fuel economy*.

These vastly improved engines were in Japan ready for duty at the outbreak of the Korean hostilities. Today, two types of Allison jet engines in three types of U. S. jet fighters are in combat in Korea—spreading destruction among enemy air and ground forces with a degree of availability and reliability never before equaled.

Today, the 10,000 Allison jet engines have accumulated more than 800,000 hours in the air.

This means that Allison jet engines lead the world in experience—where it counts most—*in the air*.

Builders of the J33 and J35 Turbo-Jet engines and T40 series Turbo-Prop engines.

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